JANUARY, 1953 — FIFTY-NINTH YEAR

MACHINERY

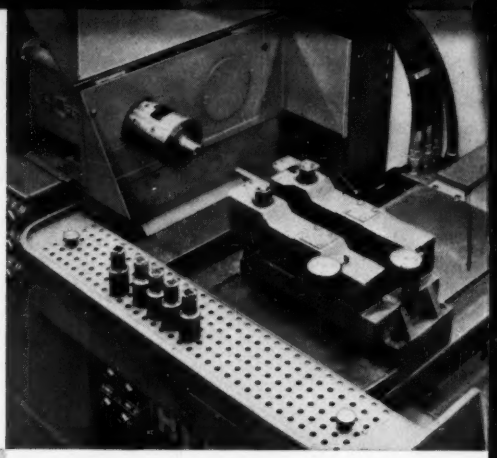
ARMSTRONG
System of TOOL HOLDERS

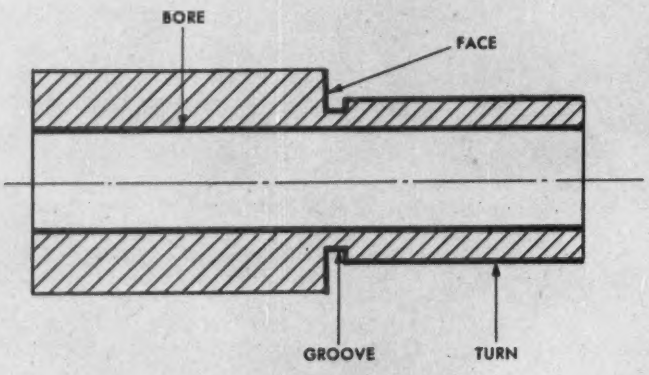
Each ARMSTRONG TOOL HOLDER equals a complete set of sihgle purpose tools as is well demonstrated in the ARMSTRONG 3-Bar Boring Tool. This boring tool holds bars of three diameters, each with end caps to hold cutter-bits at angles of 90° for boring, 45° for boring and facing and 30° for internal threading. Cutter bits for use in these boring bars are quickly ground to any needed form from stock shapes of high speed steel. The "ARMSTRONG System" provides permanent, multi-purpose ARMSTRONG TOOL HOLDERS for every operation on lathes, planers, slotters and shapers.

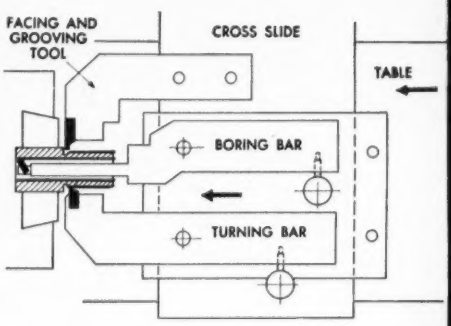
STRONG
TRADE MARK

ARMSTRONG BROS. TOOL CO. *"The Tool Holder People"* CHICAGO, U.S.A.

pinion blanks
bored – turned – grooved – faced
at 62 PARTS PER HOUR!

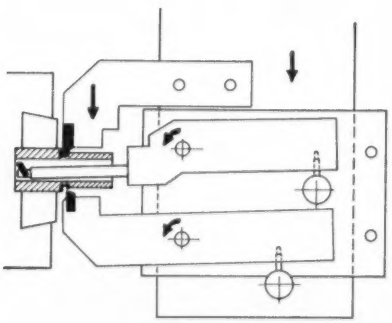






SIMULTANEOUS BORE AND TURN

After part is loaded, table rapid traverses to left and slows to bore and turn simultaneously to positive stop.



SIMULTANEOUS FACE AND GROOVE

At end of boring and turning stroke, cross slide indexes forward, retracts boring and turning tools .010" away from work and brings facing and grooving tool to operate on work — then resets to a point which leaves all tools clear of the work surfaces, thus eliminating any drag line as the table runs out to rest.

Heald Model 221 Bore-Matic performs four separate operations in one high-speed automatic cycle.

● When you can precision finish four separate surfaces in less than a minute — loading time included — that's real production efficiency!

The Heald Model 221 Bore-Matic shown above does just that — with a capacity of 496 parts per eight-hour day. What's more, the machine includes provision for future addition of a second work station, which could nearly double this figure.

Tooling consists of two dial bars for the boring and turning tools, plus a tool block mounted on the cross slide for the facing and grooving operations. Boring bars are retracted after borizing to eliminate drag line. Work is held in a quick loading collet chuck.

The entire operation — boring, turning, grooving and facing — is accomplished in a single, fully automatic high speed cycle, as shown at the right.

Remember — when it comes to precision finishing, it pays to come to Heald.

HEALD

Heald precision speeds the nation's production

INTERNAL AND ROTARY SURFACE GRINDING MACHINES AND BORE-MATICS

THE HEALD MACHINE COMPANY

WORCESTER 6, MASSACHUSETTS

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MACHINERY

VOLUME 59 JANUARY, 1953 NUMBER 5

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From— THE ORIG

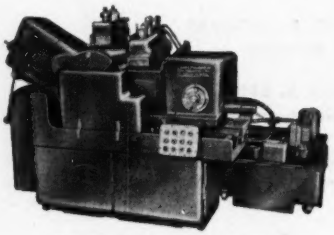
The Original Landis Die Head
Built By A. S. Landis.

From one die head built in 1889 based on a revolutionary new principle in generating threads, to over 90 sizes and styles of threading machines—that is the Landis Story.

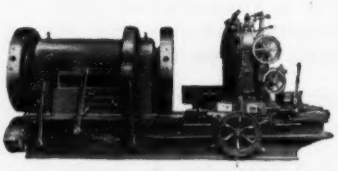
The constant research for better threading methods which has brought to Landis leadership in its field today plays an even more important part in our activities. On the record of the past stands our promise for the future.

We offer all manufacturers our years of experience in all phases of Threading. If you have a problem involving threads, whether design or production, or if you feel that your present threading methods should be improved, call on Landis.

Today—

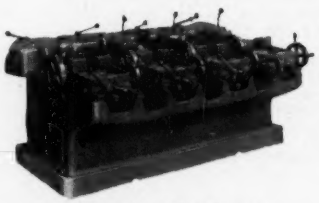


CENTERLESS THREAD GRINDER



PIPE THREADING & CUTTING OFF MACHINE

LANHYDRO DOUBLE-END MACHINE



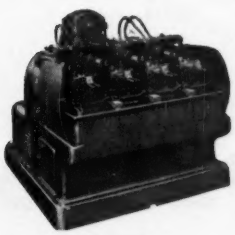
LANDMACO QUADRUPLE HEAD
THREADING MACHINE

LANDIS Machine

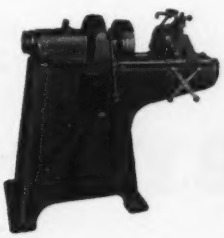
• • • THE WORLD'S LARGEST EXCLUSIVE

INAL LANDIS DIE HEAD....

LANDIS THREADING MACHINES OF EVERY TYPE - - -

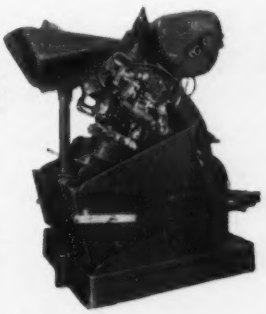


4-SPINDLE
SEMI-AUTOMATIC THREADER

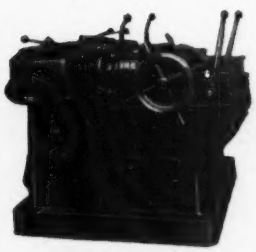


LITTLE LANDIS
THREADING MACHINE

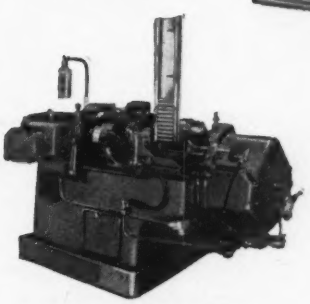
AUTOMATIC FORMING
& THREADING
MACHINE



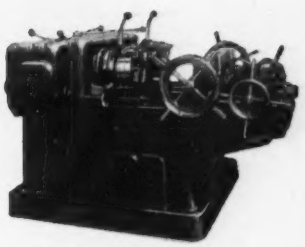
LANDIS CHASER GRINDER



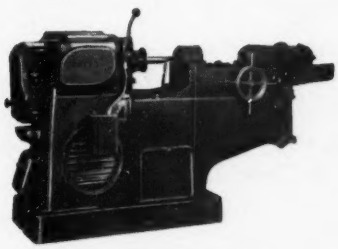
DOUBLE LANDMACO
PIPE & NIPPLE MACHINE



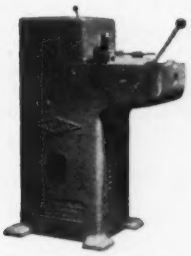
AUTOMATIC NIPPLE MACHINE



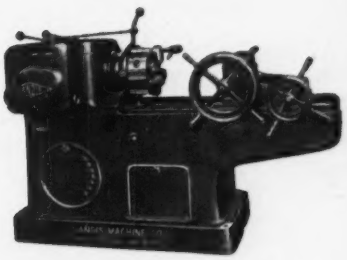
LANDMACO DOUBLE HEAD
THREADING MACHINE



LANDMACO SHELL TAPPER



⅜" THREADING MACHINE

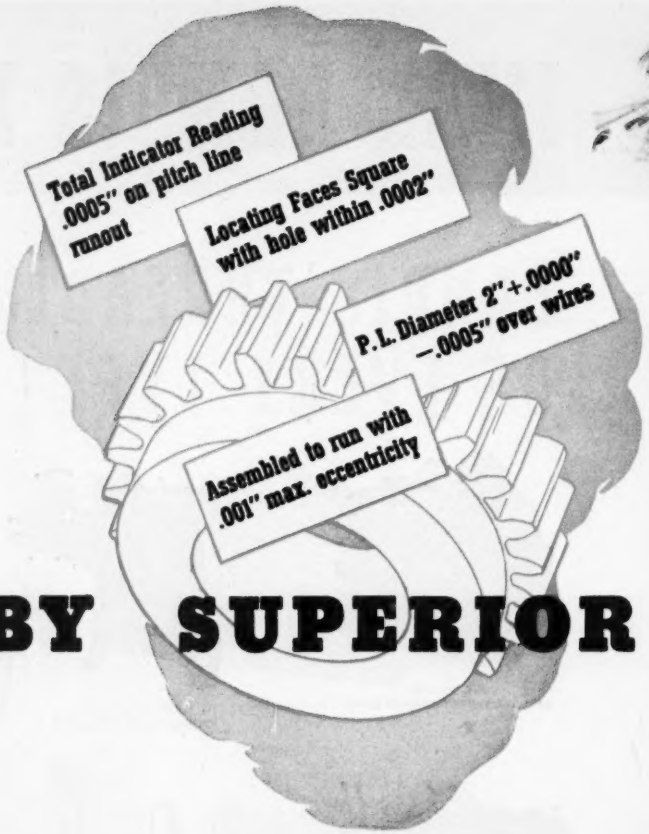


LANDMACO SINGLE HEAD
THREADING MACHINE

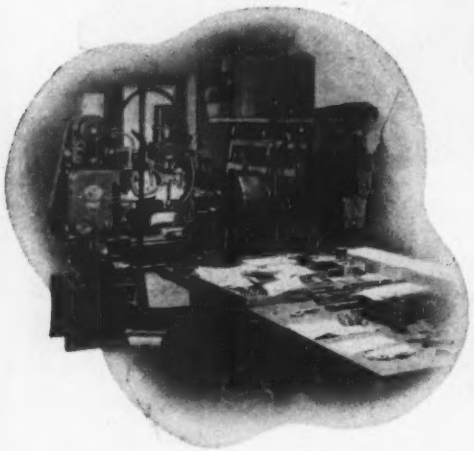
COMPANY LANDIS WAYNESBORO PENNSYLVANIA

MANUFACTURERS OF THREAD GENERATING EQUIPMENT

Superior Quality


Total Indicator Reading .0005" on pitch line runout
Locating Faces Square with hole within .0002"
P. L. Diameter 2"+.0000" −.0005" over wires
Assembled to run with .001" max. eccentricity

BY SUPERIOR



Often in these times, there is need for gears beyond the normal possibilities of so-called mass production.

Happily, though, there are shops where scant tenths-of-a-thousandth are considered generous tolerances—shops where super-precision gear cutting is still traditionally a matter of personal pride with the men who meticulously prepare the blanks and closely supervise the cutting of the teeth.

Fellows is pleased to have just such a customer in Haxton Gears, Inc. of East Rockaway, L. I., New York—and pleased, also, to show the industry these photographic glimpses of their precision work in progress, with the results achieved. If you have quality gears to tool up for, an engineer from the Fellows office nearest you can discuss methods, tooling and costs on a practical basis.

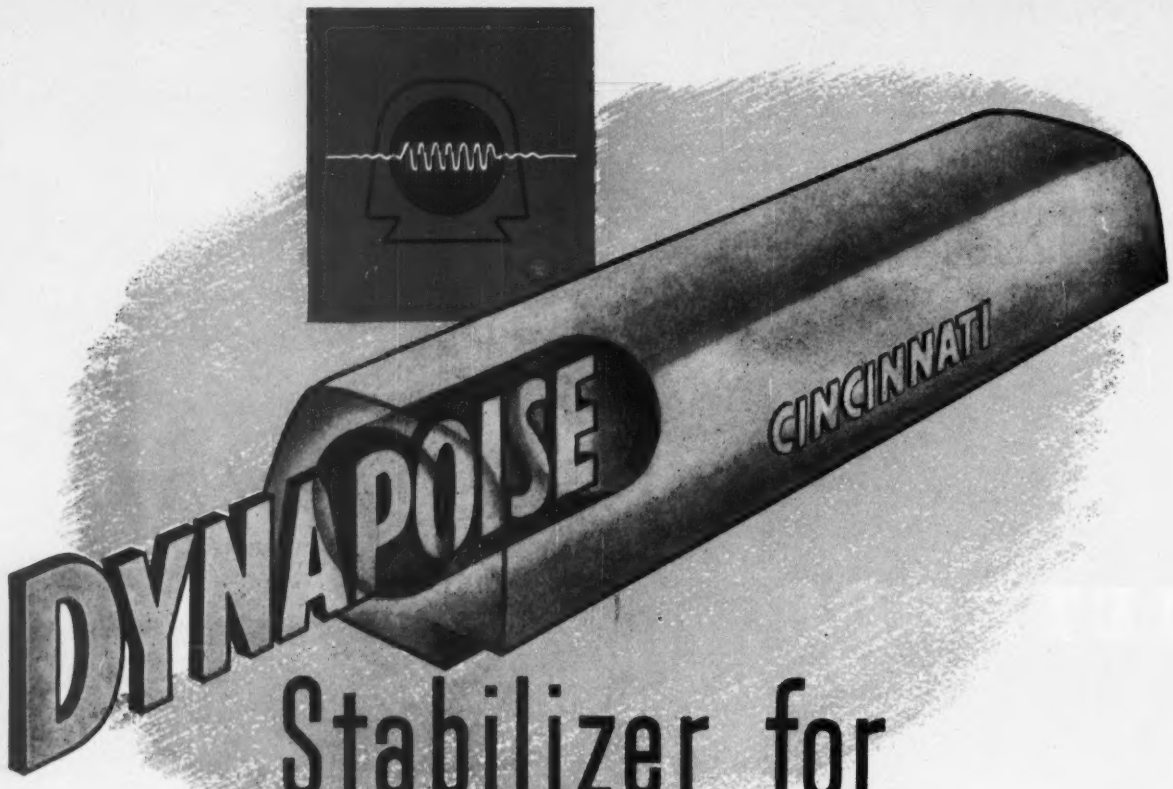
Fellows

THE FELLOWS GEAR SHAPER COMPANY • Head Office and Export Department • 78 River Street, Springfield, Vermont
Branch Offices: 323 Fisher Bldg., Detroit 2 • 5835 West North Avenue, Chicago 39 • 2206 Empire State Bldg., New York 1

METHODS

GEAR SHAPERS
SHAVING MACHINES
THREAD GENERATORS
CUTTERS AND SHAVING TOOLS
GEAR INSPECTION INSTRUMENTS

PLASTICS MOLDING MACHINES



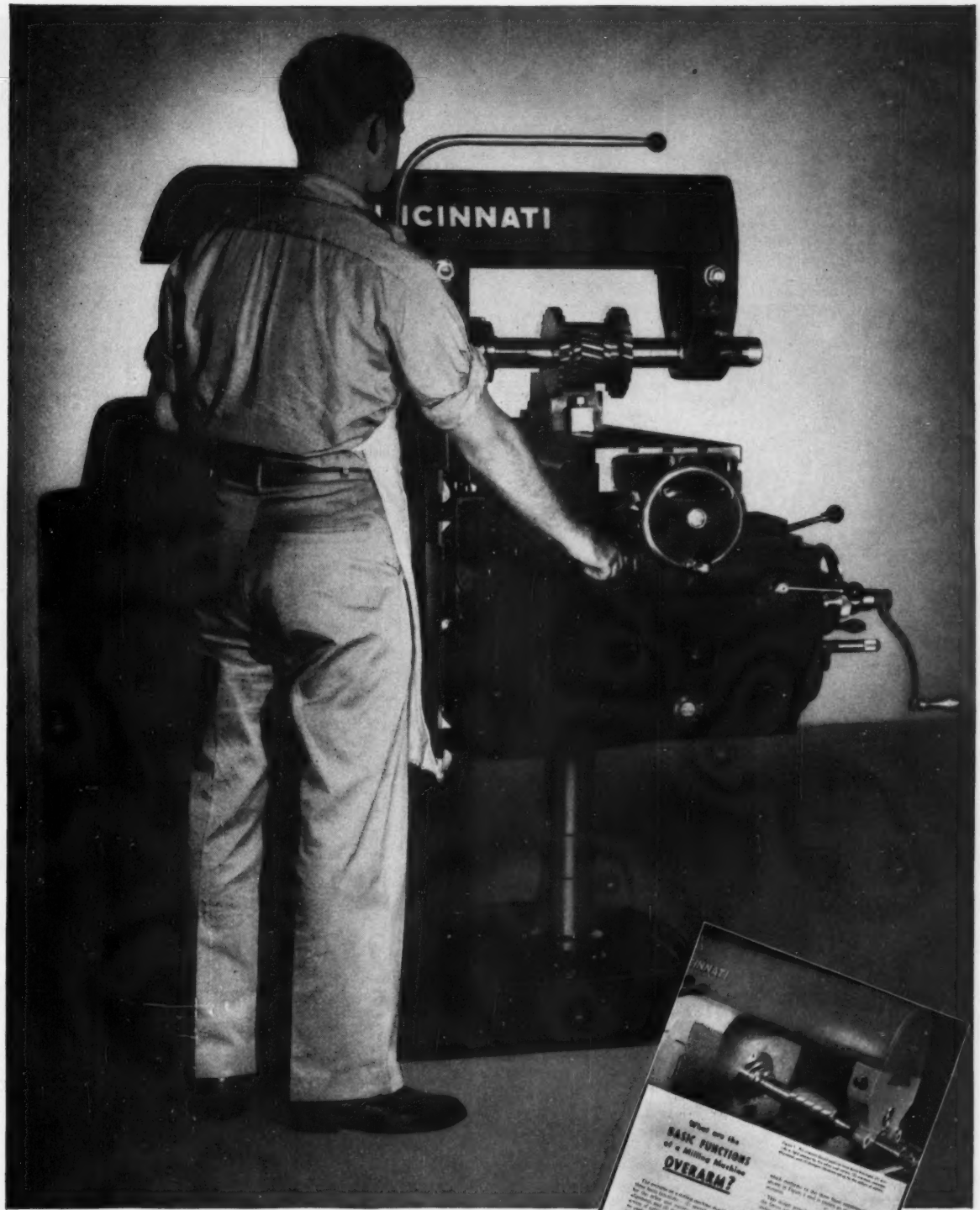
Stabilizer for Excitable Setups

Some types of milling setups have a tendency to squeal like a pig. The Dynapoise Overarm, an exclusive Cincinnati feature, takes out the squeal, allowing higher speeds and feeds to be used. And absence of chatter is easier on the operator's nervous system, too. ¶ This is just one of the many advantages offered by CINCINNATI Nos. 2ML and 2MI Milling Machines. Others include quick, easy selection of spindle speeds. One-half turn of a single crank, right or left, does the job. A similar arrangement at the front of the knee is provided to select feeds. The vertical screw is automatically lubricated in a bath of oil from an individual reservoir. To simplify maintenance, spindle speed drive gears and feed drive gears may be removed as separate units. An *automatic* backlash eliminator device for the table feed screw can be built into the saddle, if desired. It adds "climb" milling operations to the variety of work assignable to the 2MI. Add all these advantages together and you'll come up with only one answer . . . CINCINNATI *is the best buy.* ¶ CINCINNATI Nos. 2ML and 2MI Milling Machines are built in plain and universal styles (3hp and 5hp respectively), and the No. 2MI in vertical style (5hp). Brief data in Sweet's Catalog File for Mechanical Industries, or complete information may be obtained by writing for catalog No. M-1662-2.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

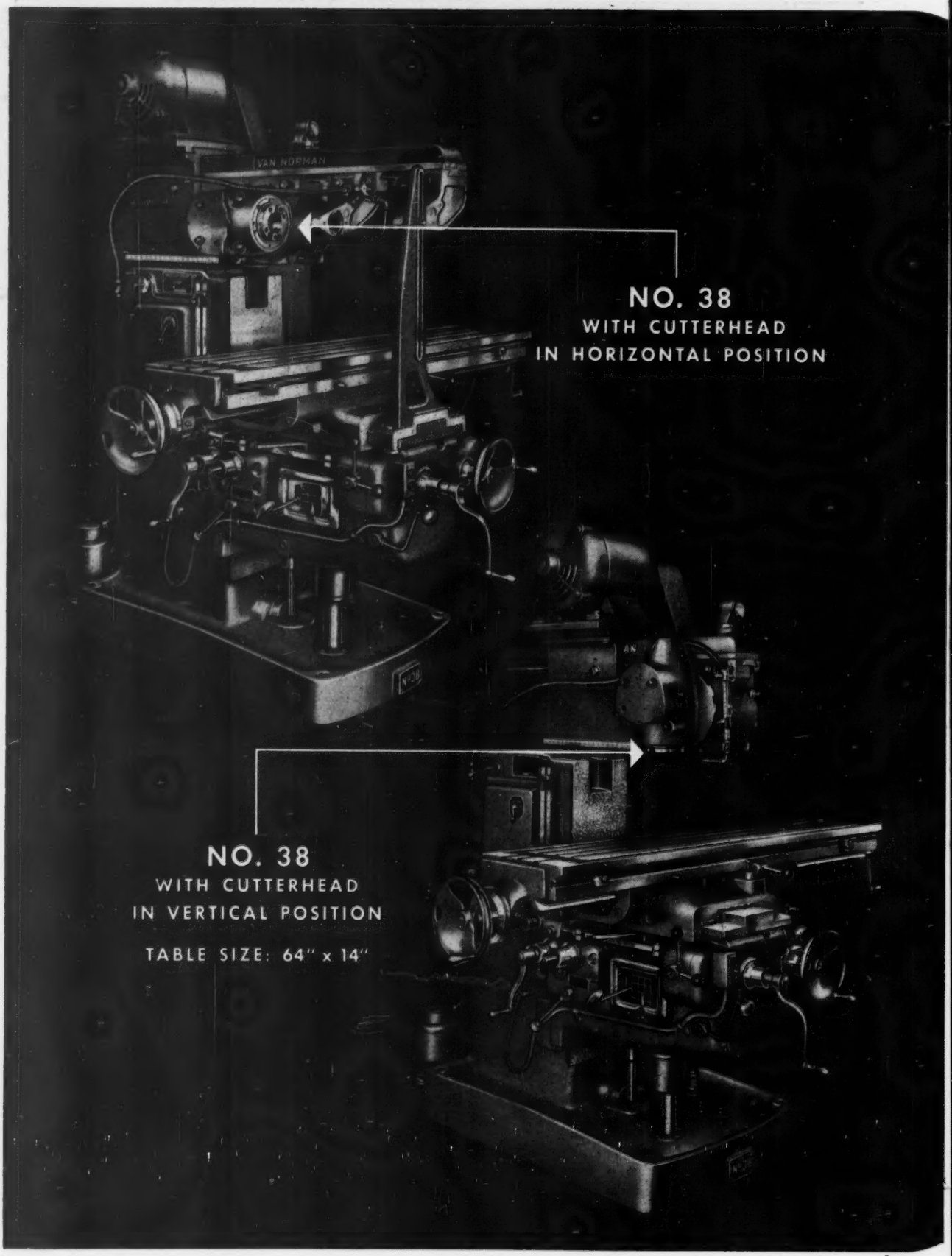
CIN



Wide cuts are no longer a nerve jarring operation with Dynapoise Overarm on the job. The machine is a CINCINNATI No. 2MI Plain Miller. An informative circular titled "What are the Basic Functions of a Milling Machine Overarm?" will be sent on request. Please ask for it by number—M-1686.

CINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID


VAN NORMAN
NO. 38
WITH CUTTERHEAD
IN HORIZONTAL POSITION
NO. 38
WITH CUTTERHEAD
IN VERTICAL POSITION
TABLE SIZE: 64" x 14"

VAN NORMAN

Ram Type Millers Give You

MORE USEFUL WORKABILITY per Machine

The advantage of Van Norman Ram Type Millers is their versatility to meet the daily milling requirements by enabling operators to perform horizontal, angular or vertical milling, using conventional milling practice and standard arbors and cutters, all with one machine.

Not only does this important feature give you the workability of several single machines, but it also minimizes work set-ups . . . cuts idle machine and operator time by permitting you to meet job to job milling requirements as they occur.

In addition, the movable ram in combination with the saddle cross feed increases the work range and capacity of work that can be handled.

Because Van Norman Ram Type Millers enable you to meet all milling jobs, they keep operators and machines working. They cut costs, improve accuracy and increase production.

Write for information and catalog describing Van Norman Ram Type Millers.

VAN NORMAN COMPANY

SPRINGFIELD 7, MASSACHUSETTS

Quick Change of Set-Up Makes

...features of

Landis 10" x 24" Type CH Universal Grinder

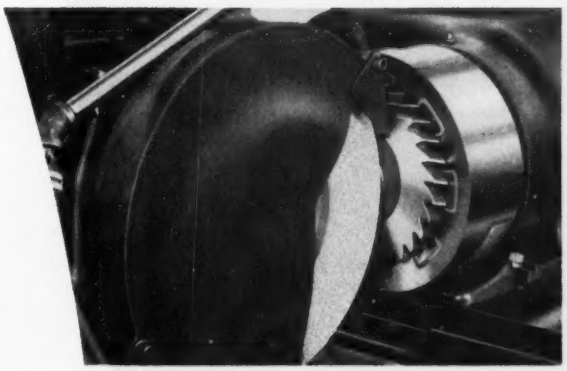
LANDIS

precision grinders

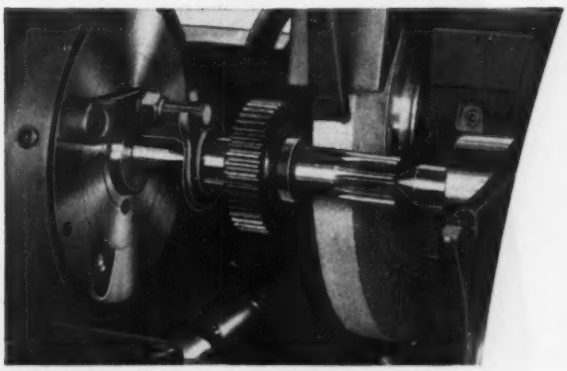
Modern operating features of Landis Universal Grinders permit quick set-ups. This gives flexibility and economy of operation for small lot manufacturing, toolroom and maintenance work. Write for Catalogs. Landis Tool Company, Waynesboro, Pennsylvania.

Small Lot Grinding Profitable

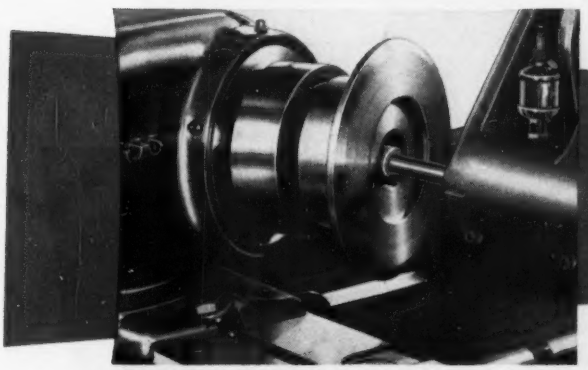
Landis Universals cut costs on precision grinding operations



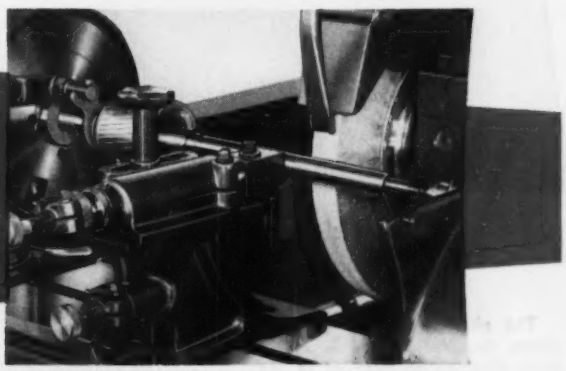
FACE GRINDING—magnetic chuck and low, compact swivelling headstock. Operator can make fast selection of correct speed.



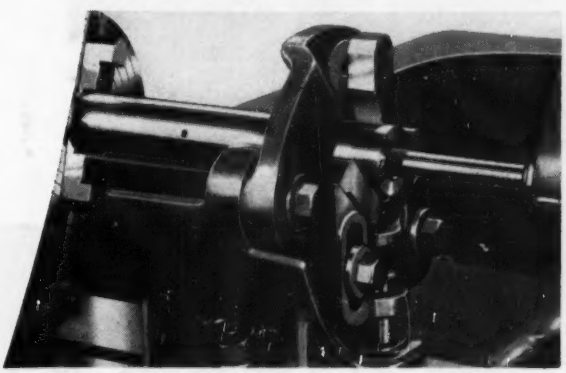
INFEED GRINDING—precision wheel feed and Microsphere wheel spindle bearings give accurate results and fast sparkout.



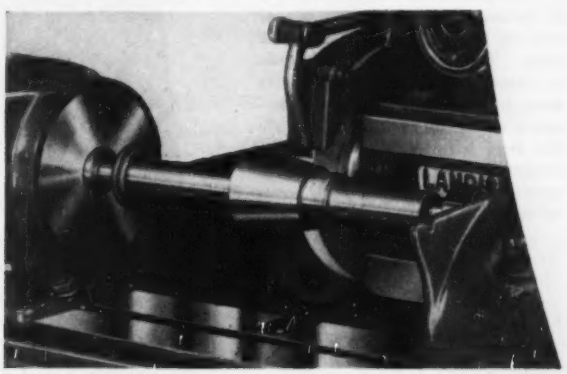
INTERNAL TAPER GRINDING—modern swing-type fixture provides quick changeover from external to internal grinding operations.



TRAVERSE GRINDING—use of automatic wheel feed saves time on short run traverse grinding jobs.

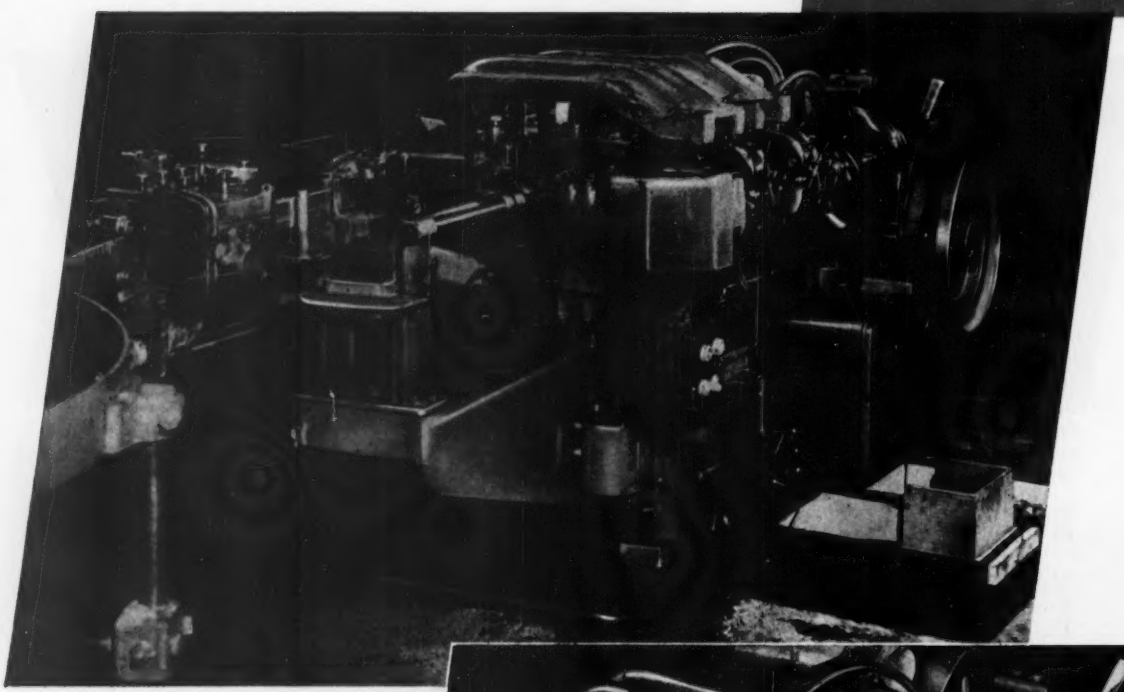


INTERNAL GRINDING—deep hole inside long work piece held in chuck and center rest. Wide variety of quills and wheels available.



TAPER GRINDING—tapers are easily ground. Piece shown has taper of 14° included angle. Wheelbase and headstock also swivel.

6100



The photograph directly above shows the No. 33 U. S. Multi-Slide Machine as installed in the plant of P. R. Mallory & Co., Inc., Indianapolis, Indiana.

The photograph at the right is a close-up illustrating the use of two die heads or rams at the same time. The use of two die heads or rams at the same time permits staggering the piercing and trimming punches, etc., to distribute the load between the rams. This results in increased runs between grinds and also in increased overall tool life.

PRODUCTS

U.S. TOOL

Stampings per Hour!

Electrical Part Requiring 23 Separate Operations Produced Complete on the U.S. Multi-Slide®

The photographs on the facing page illustrate an installation of a No. 33 U. S. Multi-Slide Machine® in the plant of P. R. Mallory & Co., Inc., Indianapolis, Indiana, world-famous producers of contact points, powdered metal parts, electrical and radio components.

On this machine they are producing a complicated stamping for the electrical industry which requires the performance of 23 separate operations. These operations are handled simultaneously in the No. 33 U. S. Multi-Slide, and the parts are produced at the rate of 6,100 per hour. This is just one example of the production and cost-saving possibilities of U. S. Multi-Slide Machines.

Produce Parts Complete — Reduce Costs — Increase Production

One of the outstanding features of these machines is their ability to produce, complete at each stroke, parts which would ordinarily require secondary operations and handlings if produced on conventional presses. Because formed stampings are produced uniformly and to close tolerances with U. S. Multi-Slides, quality is improved and yet the number of necessary inspections is reduced.

Get Greater Versatility

The various movements obtainable on U. S. Multi-Slides are provided by units which are part of the machine equipment, and do not have to be built into the tools. Tools for any one size of U. S. Multi-Slide can be used with any other U. S. Multi-Slide of the same size.

If your production involves piercing, trimming, embossing, swaging, stamping, forming and similar operations, write for a copy of Bulletin 15-M, which gives complete specifications of all four U. S. Multi-Slides.

®Trade Mark Registered—U. S. Patent Office

COMPANY, Inc. AMPERE (East Orange) NEW JERSEY

Builders of U. S. Multi-Slides—U. S. Multi-Millers

U. S. Automatic Press Room Equipment—U. S. Die Sets and Accessories

KEARNEY & TRECKER MILWAUKEE

CH MILLING SPEED, ACCURACY

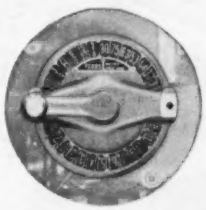
Here's a job handled on a new CH-4 Machine

Job: Menasco Mfg. Co., Burbank, Calif. — Straddle Milling Drag Links
Machine: No. 4, Model CH, Plain Style
Part: Shock strut for landing gear cylinder
Cutters: High speed steel inserted tooth
Cutter Speed: 18 rpm, 1 1/32 ipm feed
Chip Load: .005"
Material: 4140 Steel forging, 43 Rockwell

MACHINE COMBINES AND POWER

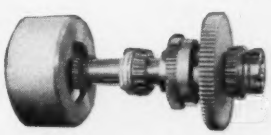
CH MILLING MACHINE FEATURES THAT HELPED DO THIS JOB BETTER

Speed range—*24* speed changes are provided from *15* to *1500* rpm. Automatic protecto-mesh mechanism permits nonclash shifting during speed changes.

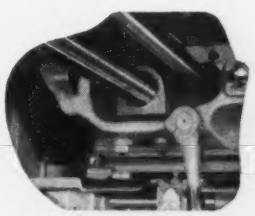


Extra wide feed range — *32* changes from ⅜" to *90"* per minute meet requirements of new metals and cutting tools for most efficient operation.

Greater rigidity — Entirely new column . . . heavily ribbed, box section, sponson construction . . . absorbs vibration from heaviest cutting loads.



Greater cutting efficiency through design refinements and a train of heavy duty, wide-faced, forged steel gears, hardened and specially processed for quiet operation.

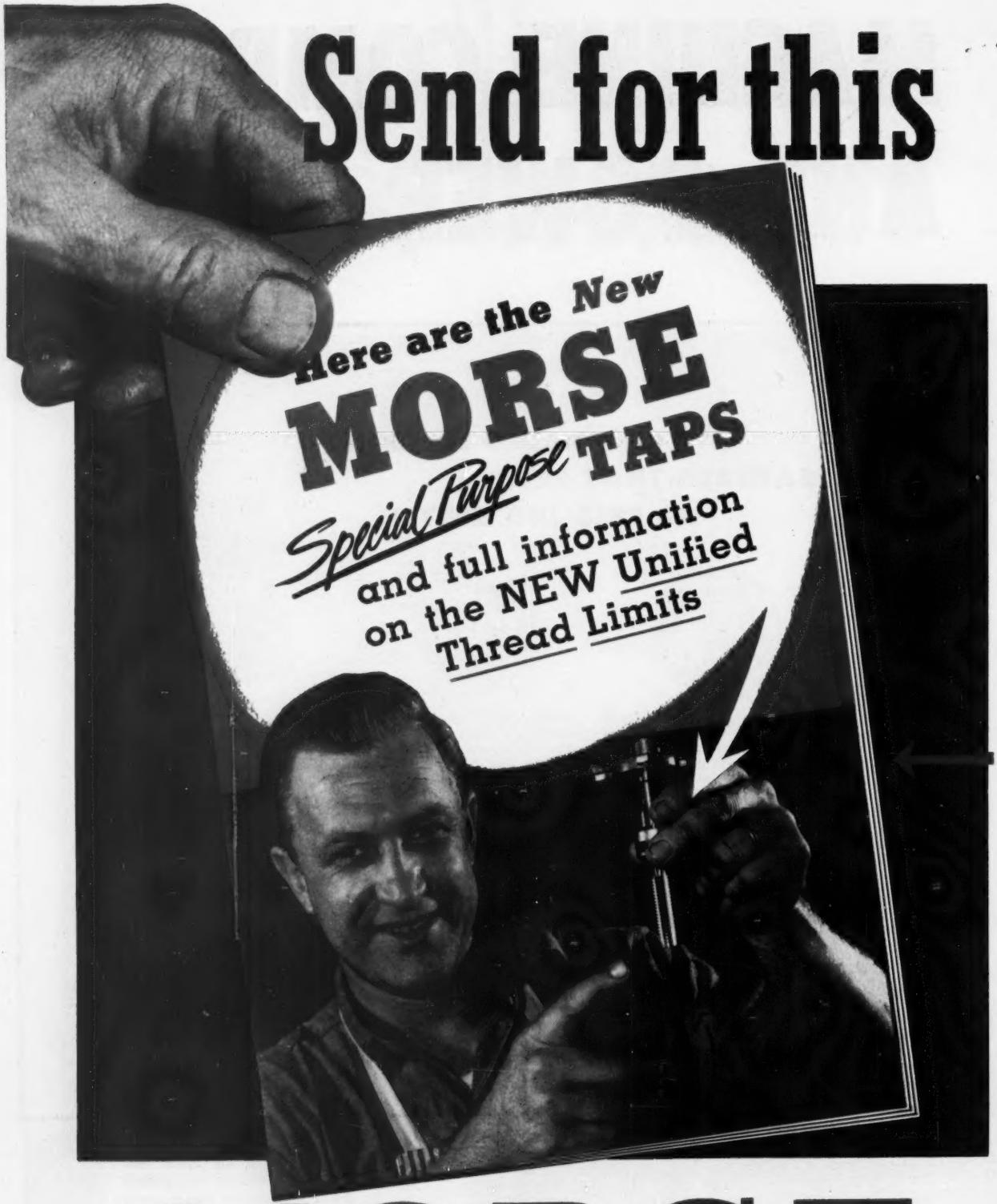


Smoother feed performance through a heavy duty *2"* dia. table feed screw. *23%* greater bearing contact between screw nut for longer screw life and accuracy.

Greater horsepower through independent drives for spindle, feed and rapid traverse, and coolant. 15 hp delivered to spindle . . . *3* hp for feed and rapid traverse . . . ¼ hp for coolant.

INVESTIGATE the new CH line of milling machines. These and other features are job proven to give you cost-cutting results plus greater productivity, better finished products. Contact our nearest representative or write: Kearney & Trecker Corp., 6784 W. National Avenue, Milwaukee 14, Wisconsin.

Send for this



MORSE

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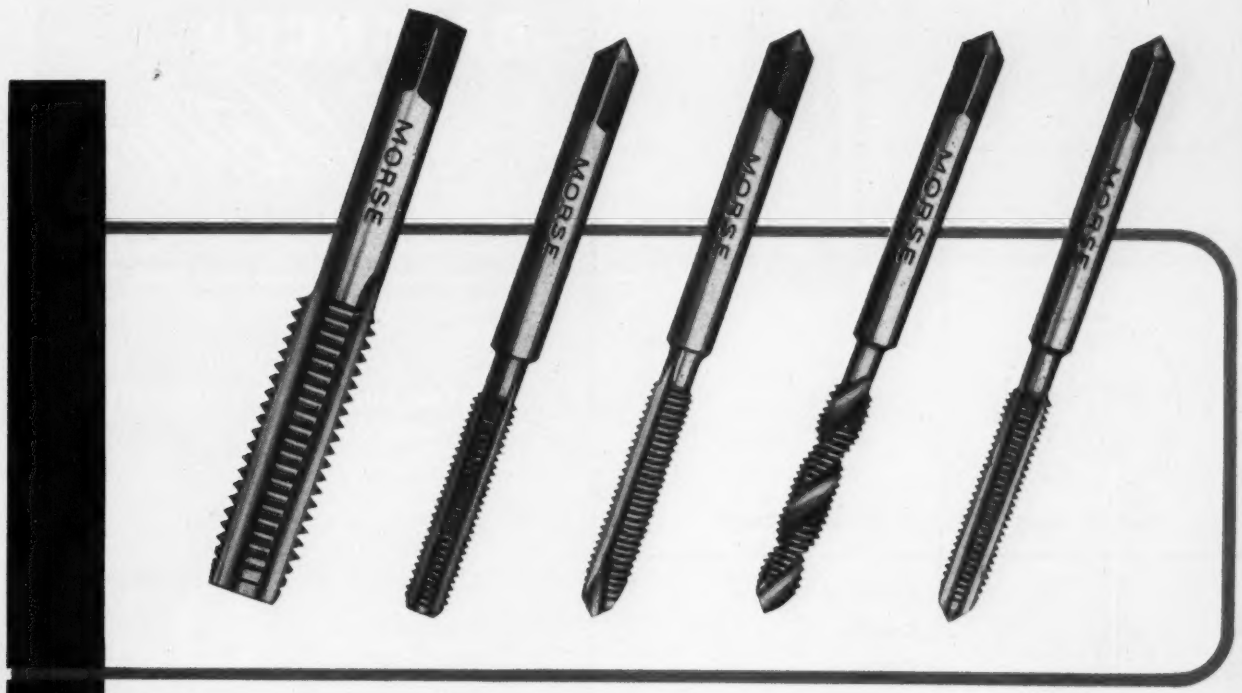

Here's the *"book of the year"* for tap-users who want performance beyond anything they have known before . . . in cast iron or brass . . . in aluminum or stainless steel . . . and in non-ferrous materials with abrasive or shrinkable characteristics.

This handy, 12-page pocket-book gives complete specifications on the new line of Morse Special-Purpose Taps . . . and shows how they differ from Morse General-Purpose Taps in either rake or hook angle, or pitch diameter. What's more, you get the whole story, in 2 quick pages, on the new Unified Thread Limits.

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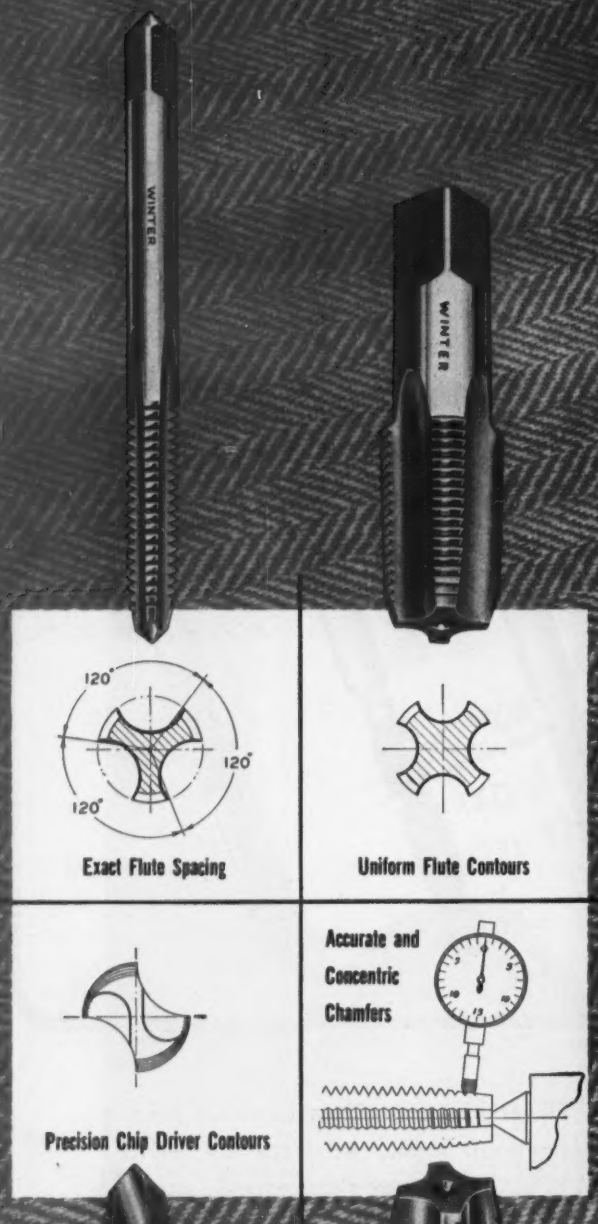

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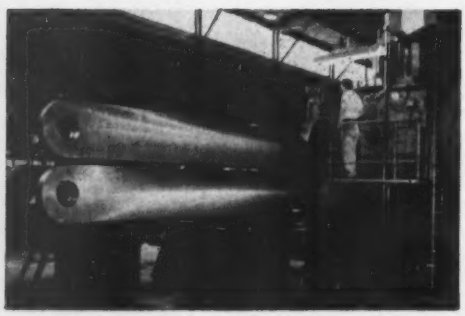
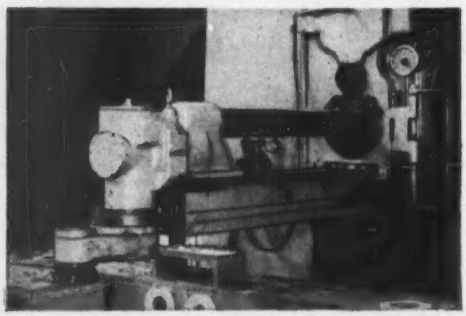
How the new G&L underarm simplifies machining huge

G&L 50-series horizontal boring, drilling, and milling machines now available with 60" underarm to reduce handling time . . . speed work



A continuous feed facing head, mounted on the underarm, machines two arms of an aircraft stretch forming press. Longitudinal travel of G&L machine's runway provides ample cross feed for long parts.



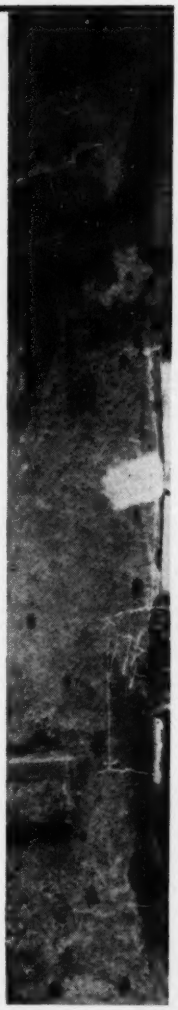
90° Offset Milling Attachment performs similarly to Angular Milling Attachment, but is used on recess surfaces that the latter cannot clear. Swivels full 360°.

NOW, with this new G&L development, it's possible to perform a vast range of operations on awkward, complex or bulky castings or forgings in a single setup. It not only speeds your work and reduces handling time — it improves overall accuracy.

Built into the machine headstock, the underarm support allows very accurate machining operations to be performed at right angles or parallel to the spindle without repositioning the workpiece. The underarm provides rigid support for heavy-duty milling, facing, boring and shaping tools at distances from the face of the headstock which heretofore had been impossible.

Six types of tools can be mounted on the underarm: 46" face plate drive, 48" continuous feed facing head, 90° angular milling attachment, 90° offset milling attachment, spindle support, and shaping attachment.

To get the details on this new work-speeding, time- and labor-saving development . . . for a rundown on G&L's complete line of heavy machine tools . . . or for information on the G&L Job Analysis Service — contact your nearest G&L representative. Don't delay — delivery on G&L machines may be better than you think.



GIDDINGS & LEWIS

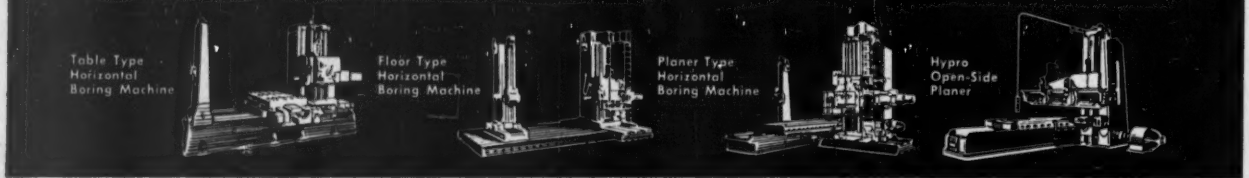


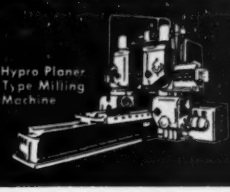
Table Type Horizontal Boring Machine
Floor Type Horizontal Boring Machine
Planer Type Horizontal Boring Machine
Hypro Open-Side Planer

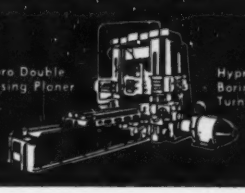
support castings

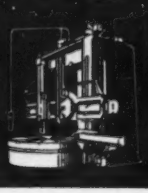
This shows an angular milling attachment mounted on the underarm with a milling cut in progress. When this surface is machined, the head will be rotated to mill the angular surface above. The end surface of the "window," the inner top, and the bottom side surfaces have already been milled. Only a single setting of the huge casting is necessary to complete all these operations.

G-21

MACHINE TOOL CO.







G&L HYPRO

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WISCONSIN

Come what may...your plant is prepared for the future...

when it's equipped with versatile LAKE ERIE *hydraulic presses*

Norris-Thermador Corp. provides another excellent example

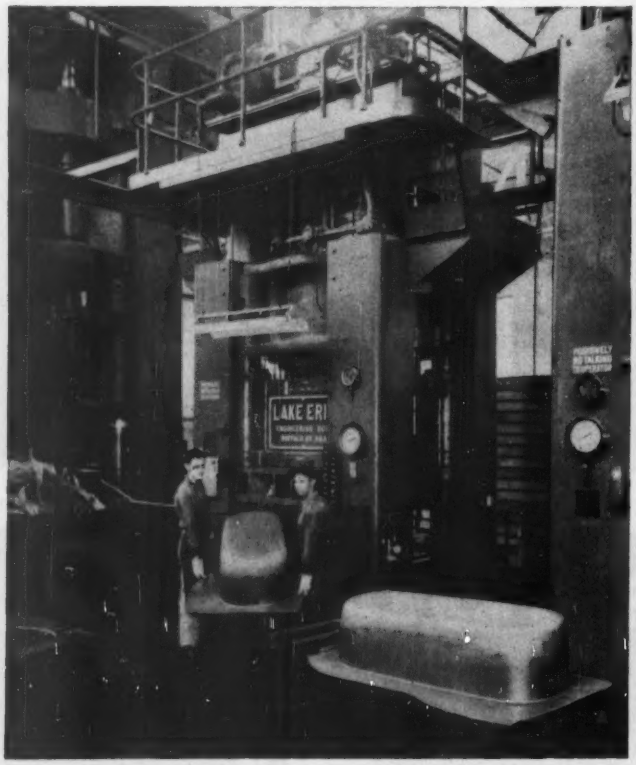
YESTERDAY...
it was bathtubs

TODAY...
it's shell casings

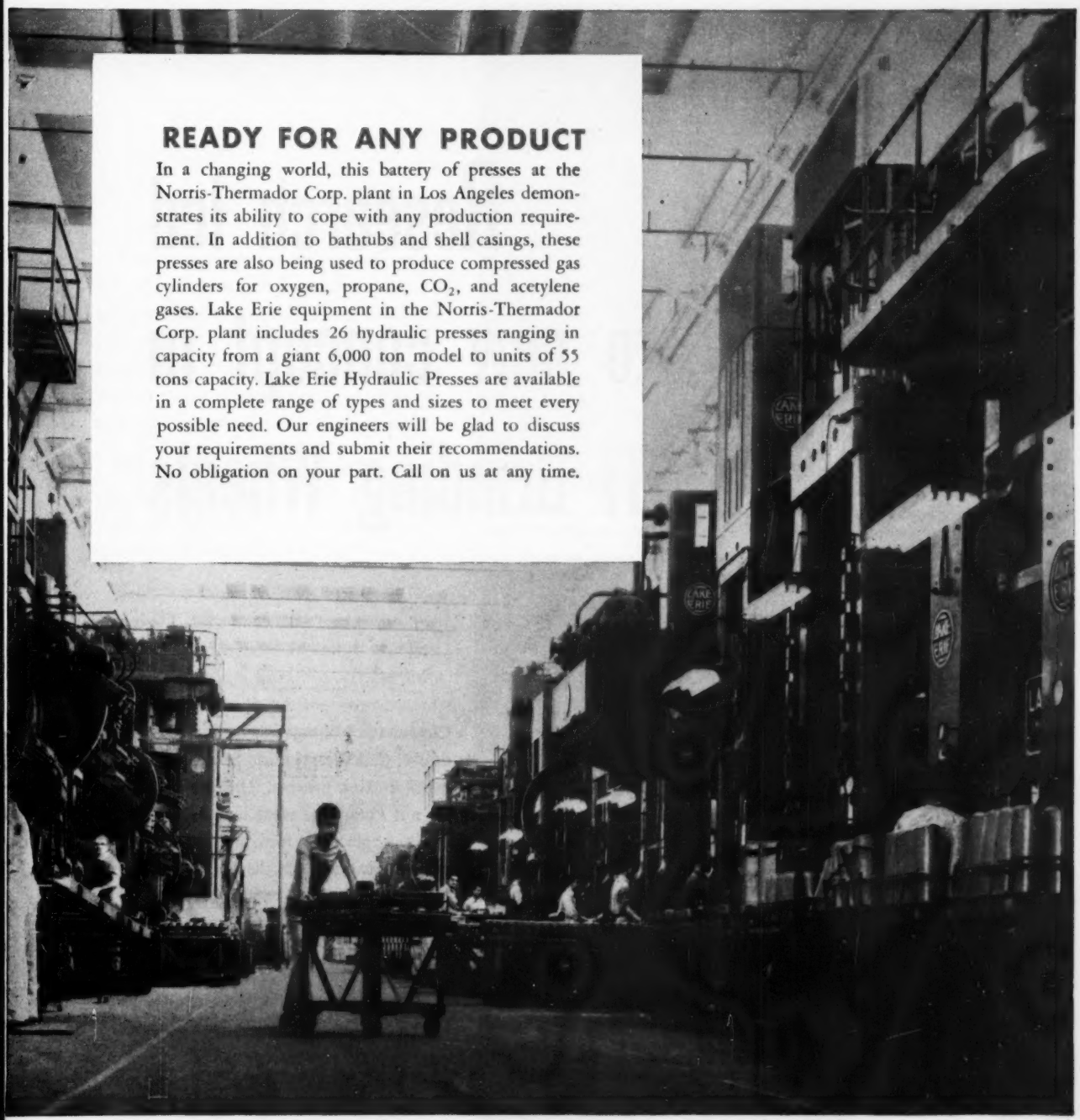
TOMORROW...
it may be another metal product

BUT...
these hydraulic presses will be ready for it.

Plant versatility is a mighty important asset... particularly today when products and markets are so prone to change on such short notice. When this versatility is coupled with high production efficiency, as it is with the fast Lake Erie hydraulic presses available today, your plant is equipped to return maximum yield on your investment. No matter what change-over you encounter—military to civilian, or vice versa... a model switch... the introduction of a new product...versatile and efficient Lake Erie Hydraulic Presses will enable you to make the change with a minimum of money, time and retooling. Why not investigate these advantages of Lake Erie Hydraulic Presses? Write or call us. No obligation.



● One of 26 Lake Erie Hydraulic Presses in the Norris-Thermador Corp. plant demonstrates its remarkable versatility. At left—drawing bathtubs, right—heading 105 mm. shell casings.



READY FOR ANY PRODUCT

In a changing world, this battery of presses at the Norris-Thermador Corp. plant in Los Angeles demonstrates its ability to cope with any production requirement. In addition to bathtubs and shell casings, these presses are also being used to produce compressed gas cylinders for oxygen, propane, CO_2, and acetylene gases. Lake Erie equipment in the Norris-Thermador Corp. plant includes 26 hydraulic presses ranging in capacity from a giant 6,000 ton model to units of 55 tons capacity. Lake Erie Hydraulic Presses are available in a complete range of types and sizes to meet every possible need. Our engineers will be glad to discuss your requirements and submit their recommendations. No obligation on your part. Call on us at any time.

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ENGINEERING CORP.
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LAKE ERIE HYDRAULIC PRESSES are available in any size . . . standard, modified and special designs—horizontal and vertical types—for Metal Working—Plastics Molding—Forging—Metal Extrusion—Processing—Vulcanizing—Laminating—Stereotype Molding—Die Casting—Briquetting—Baling—Special Purpose.

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LAKE ERIE ®

Research led to new concept in CINCINNATI Grinding Wheels

Cincinnati Milling has proved, beyond doubt, that the grinding process is a true metal cutting process. The grinding grits do not abrade or wear away the surface of a workpiece but form chips which agree in classification with the basic chip types found in other metal cutting processes.

This entirely new approach is not based on hasty conclusions. It represents 25 years of Cincinnati Milling research, coupled with practical experience in applying the basic fundamentals of grinding to a wide variety of work on both centerless and centertype machines.

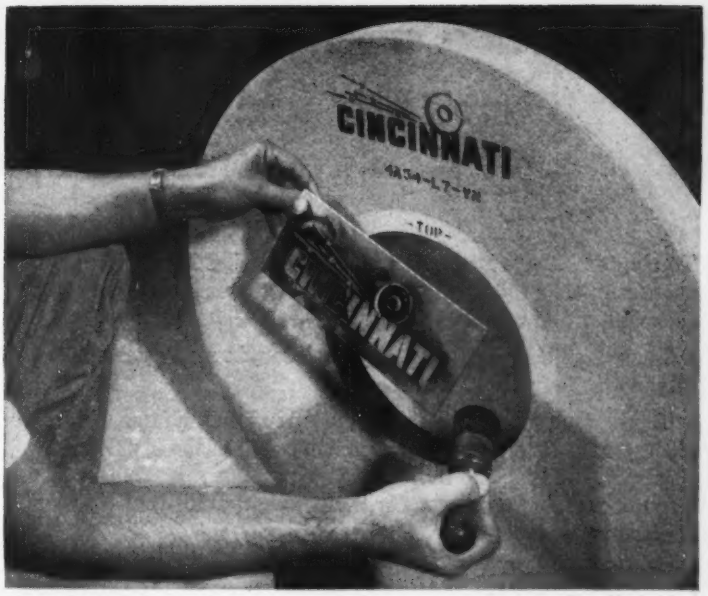
TRUE VALUES of grinding wheel wear are obtained by instrument which gives consistent measurement of changes in wheel radius within .00005".

This new concept is the beginning of a new approach to grinding wheels—the development of the wheel as a true cutting tool. And it is a development you might expect from Cincinnati Milling, with the world's largest background of research and experience in metal cutting operations.

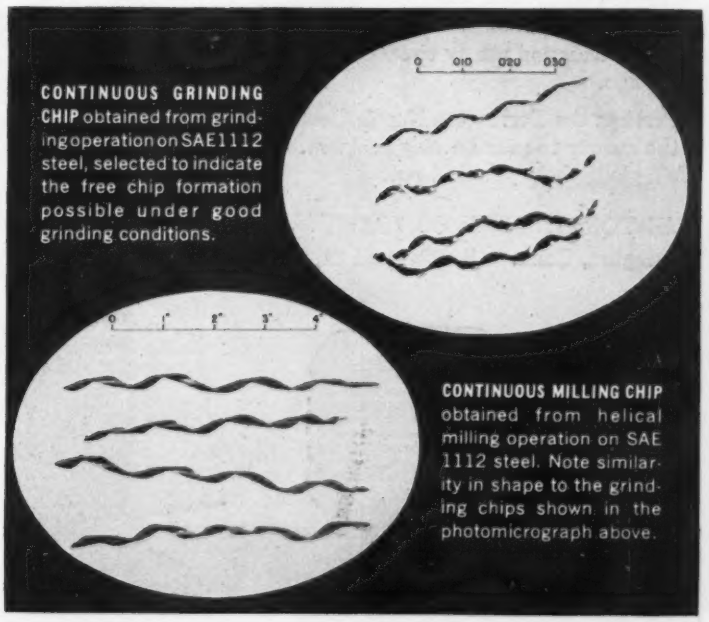
For you, this means grinding wheels developed and tested over a period of several years on the basis of true function—as true cutting tools forming true chips.

Available to you is a field organization of trained machinists who know grinding and grinding machines as well as grinding wheels. For a demonstration on your own machines of how to get the most out of Cincinnati Grinding Wheels, write, wire or phone Cincinnati Milling Products Division, The Cincinnati Milling Machine Co.

FREE BOOKLET. Now available to industry is a brand new booklet entitled "A New Concept In Grinding Wheels." It contains valuable information for everyone interested in grinding operations. For your free copy, just write Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.



FAMOUS NAME is stenciled on a wheel that has passed a battery of tests and is ready for shipment to one of the ever increasing number of customers.



CONTINUOUS GRINDING CHIP obtained from grinding operation on SAE 1112 steel, selected to indicate the free chip formation possible under good grinding conditions.

CONTINUOUS MILLING CHIP obtained from helical milling operation on SAE 1112 steel. Note similarity in shape to the grinding chips shown in the photomicrograph above.

CINCINNATI
Grinding Wheels
THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio

Are space and weight savings vital?

here's how leading aircraft manufacturers get them with NEEDLE BEARINGS

Torrington Needle Bearings are integral design features in many leading aircraft because of their light weight and compactness coupled with their high rated radial capacity.

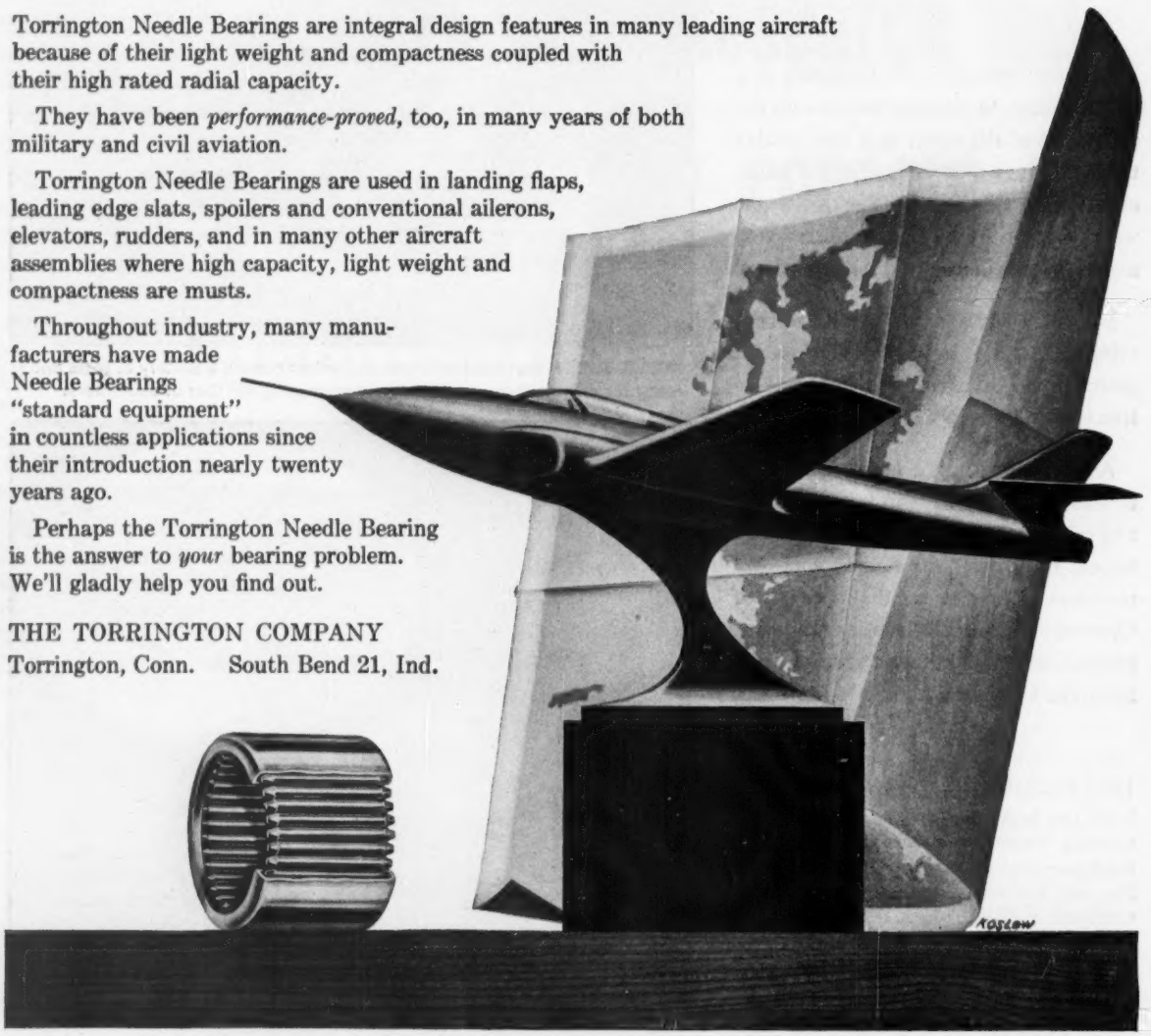
They have been *performance-proved*, too, in many years of both military and civil aviation.

Torrington Needle Bearings are used in landing flaps, leading edge slats, spoilers and conventional ailerons, elevators, rudders, and in many other aircraft assemblies where high capacity, light weight and compactness are musts.

Throughout industry, many manufacturers have made Needle Bearings "standard equipment" in countless applications since their introduction nearly twenty years ago.

Perhaps the Torrington Needle Bearing is the answer to *your* bearing problem. We'll gladly help you find out.

THE TORRINGTON COMPANY
Torrington, Conn. South Bend 21, Ind.



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Trade-marks of leading aircraft companies whose products enjoy the benefits of Needle Bearings.

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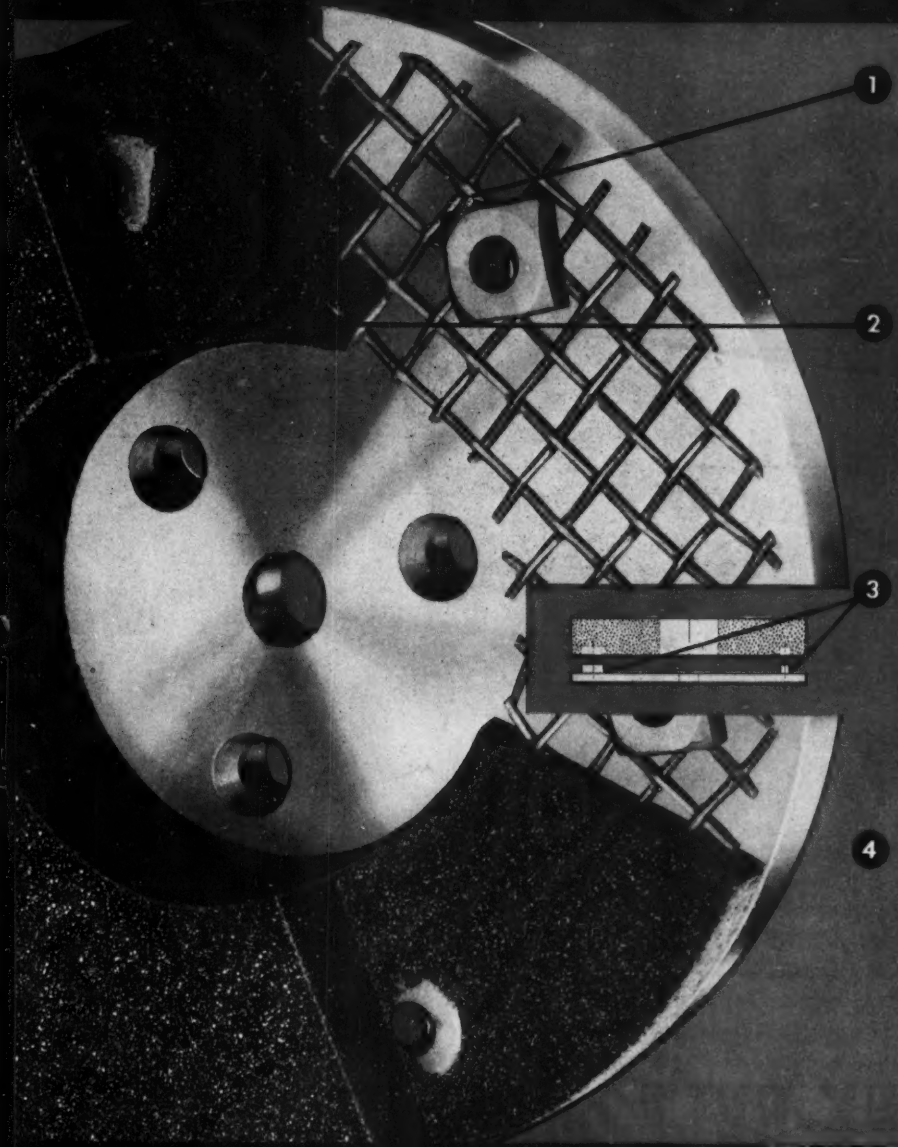
Compare the Exclusive Features

of This Abrasive Disc With Other Makes



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for positive safety

Heavy wire mesh is molded as an integral unit with abrasive. Provides maximum protection for operator.

2 **JOB-FITTED ABRASIVES**
at no extra cost

Abrasives compounded to fit needs when necessary. Production records permit exact duplication for reorders.

3 **TRU-LOK DISC MOUNTING**
for maximum precision

On GARDNER discs provided with the Tru-Lok feature, off-center mounting is impossible. Doweled Tru-Lok mounting aligns the holes in the abrasive disc and steel wheel exactly.

4 **FIELD ENGINEERING SERVICE**

A nation-wide service organization available to help you solve your flat surface grinding problems. Helps you obtain maximum efficiency and service from abrasive discs and equipment.

GARDNER

abrasive discs

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Please send me a free copy of the Gardner Abrasive Disc Guidebook.

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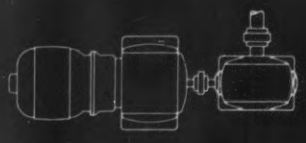
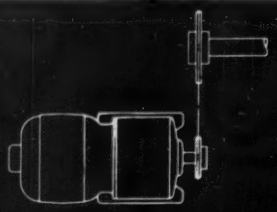
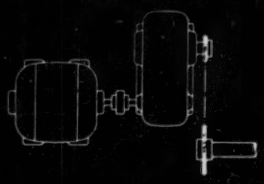
Is your speed reduction problem in this picture?



High-ratio reduction and right-angle takeoff

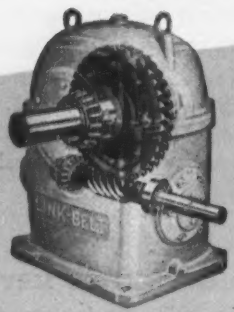


Restricted Space for mounting



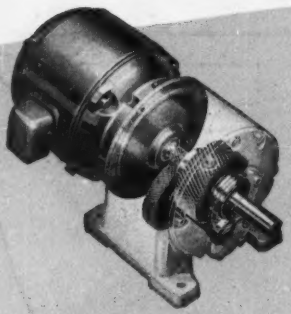
High hp with parallel takeoff

If it is, LINK-BELT has the right reducer for your requirements



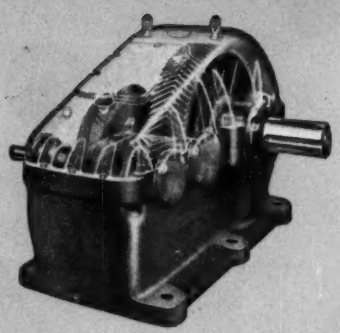
Worm Gear Drive

Reduction ratios: 3.1:1 to 8000:1. Torque: 1400 to 123,000 in. lbs. Output shaft rpm: 0.22 to 564. Drawing shows motorized P.I.V. variable speed and worm gear drives direct-coupled.



Gearmotor

Reduction ratios: 6.2:1 to 292:1. Hp range: 1 to 30. Output shaft rpm: 6 to 280. Drawing at top of page shows gearmotor with roller chain drive.



Herringbone Gear Drive

Reduction ratios: 2.84:1 to 318:1. Hp range: ½ to 1000. Output shaft rpm: 2 to 600. Drawing at top of page shows motor with herringbone gear drive and roller chain drive.

Yes, LINK-BELT builds all 3

HELICAL, Herringbone or Worm gear drive—Link-Belt builds them all. And all are made in the widest range of hp ratings and reduction ratios. Truly a specific drive for every reduction problem.

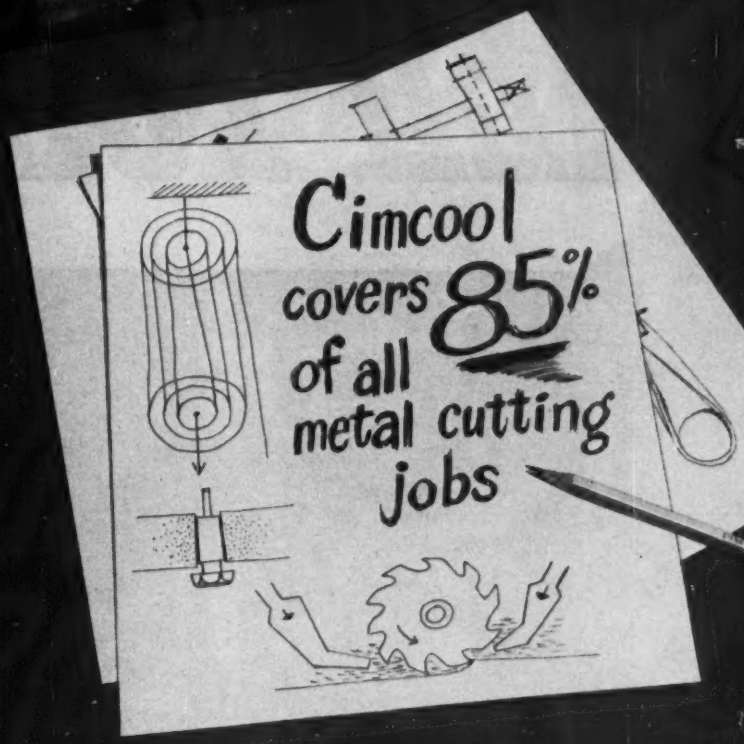
All of this enables the Link-Belt power transmission engineer to recommend the *one* drive best suited to your requirements. And you can be equally sure that every Link-Belt drive is precision engineered for quiet, economical, long-life service.

Call the Link-Belt office near you for engineering information on any or all of these enclosed gear drives. Send for catalogs.

LINK-BELT

ENCLOSED GEAR DRIVES

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa), Sydney (Australia). Offices, Factory Branch Stores and Distributors in Principal Cities. 12.001



. . . and does a better job!

JOT THIS DOWN, TOO: Cimcool° is the radically new and different cutting fluid that also lowers costs . . . permits faster speeds . . . increases accuracy . . . helps increase tool life.

Cimcool is superior to old-fashioned coolants because it is a chemical emulsion. It replaces all water emulsions and all but a few highly compounded specialty oils. Cimcool permits faster speeds and increases tool life because it combines friction reduction and cooling capacity in a degree never before attained. It's longer lasting in machines. So Cimcool reduces downtime and cuts labor costs for cleaning and changing.

For a demonstration in one of your own machines, just write us and we'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Or, if you prefer, write for our free booklet, "CIMCOOL Defeats Heat." Address Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

A Production-Proved Product of
THE CINCINNATI MILLING MACHINE CO.

for **85%**
OF ALL METAL CUTTING JOBS

POWERED FOR

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER &

PRODUCTION

WARNER & SWASEY Saddle Type Turret Lathes deliver tremendous power for the toughest jobs. The one-piece bed, with integrally cast head and VEE-WAYS, carries massive solid weight at the right places. And with diagonal cross-ribbed reinforcing it insures the rigidity that holds accuracy.

You can really hog off tough metal *fast* with any Warner & Swasey Heavy Duty Machine. You can give the job everything that carbide tooling can take.

And along with power, these machines have an industry-wide reputation for *holding* their precision accuracy. Warner & Swasey's are built to provide the right combination of power, speed and accuracy for the most rugged, heavy duty service throughout many years of trouble-free service.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

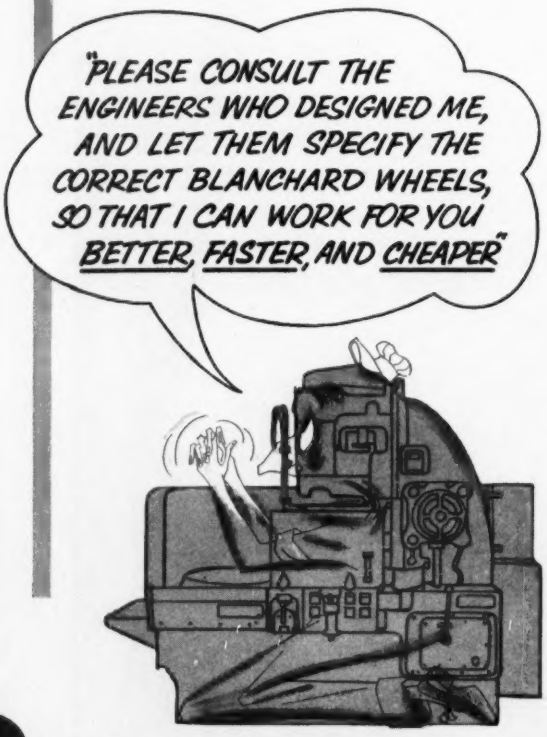
UNCLE!

Are your machines begging for mercy because of misuse?

Blanchard Grinders, *with proper grinding wheels, can* and *do* give high production with extremely close tolerances for dimension and flatness. However, a No. 11 Blanchard user recently received erroneous advice on abrasive wheels from an outside source. The result was that 35 high-speed cam plates were ground on both sides in 1¼ hours with surface finish of 24 micro-inches.

By referring the problem to Blanchard, it was easily demonstrated that the No. 11, with correct grinding wheel, would give desired results—90 to 100 cam plates per hour, with surface finish of 4 micro-inches, dimension tolerance of ±.0002, and flat within 2 light bands.

Blanchard wheels are best for Blanchard Grinders — let Blanchard give you the benefit of their vast experience so that you too can get the most from your Blanchard machines.

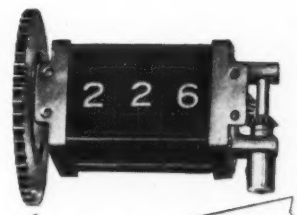

"PLEASE CONSULT THE ENGINEERS WHO DESIGNED ME, AND LET THEM SPECIFY THE CORRECT BLANCHARD WHEELS, SO THAT I CAN WORK FOR YOU BETTER, FASTER, AND CHEAPER"

Information on correct surface grinding procedure and wheel selection are given in "Work Done on the Blanchard" and "The Art of Surface Grinding." Write for free copies today!

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.



Small Component... or Complete Unit... You can count on getting whatever You* need—*

Added Evidence that—

Everyone Can Count on VEEDER-ROOT

This REEL CONTROL BOX, complete with its *built-in* counting mechanism, indicates the number of feet of antenna reeled in and out of certain types of military aircraft. Manufactured completely by Veeder-Root, including outside bakelite cover and box, this unit shows another imaginative application of the universal language of direct-reading *Count*rol.

Now if you, *in any of your defense work,** have a counting problem, then you can count on Veeder-Root to help you in every possible way.

VEEDER-ROOT INCORPORATED
"The Name That Counts"
HARTFORD 2, CONN. • GREENVILLE, S.C.
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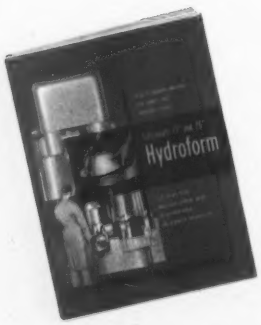
"Counts Everything on Earth"

Hydroforming

improves the quality of deep drawn parts

CINCINNATI 26" HYDROFORM

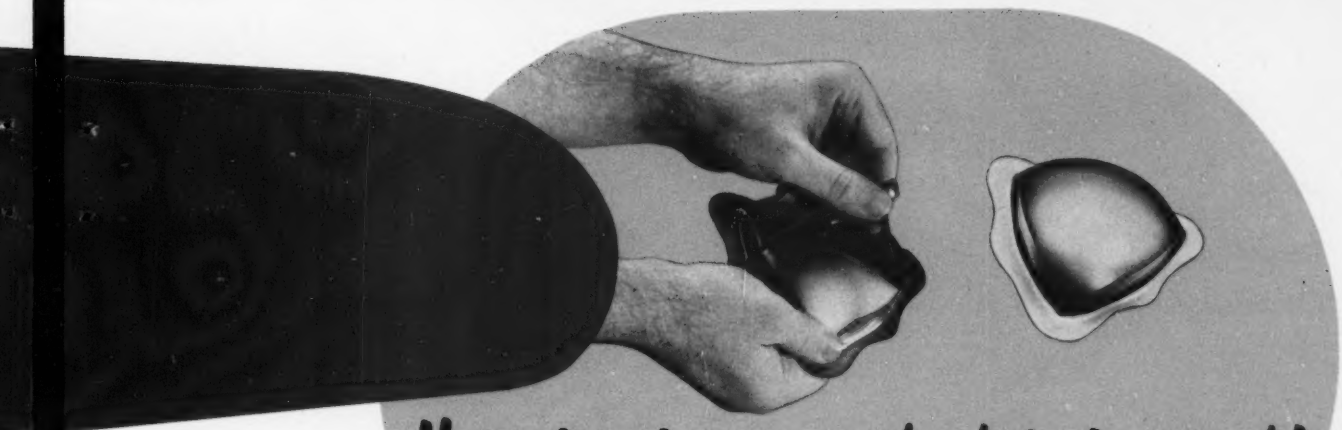
Also built in 12", 19", 23" and 32" standard sizes. Machine size indicates maximum blank diameter that can be formed. Material thickness can range from foils to 3/8" steel.



Write for your copy of Hydroform Bulletin M-1759

Hydroform

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



Here's deep drawing with a kid glove touch!

Pre-polished blanks of 20-gage Type 302 Stainless Steel, having a protective plastic coating over the entire blank surface, were Hydroformed in one operation to produce the Corner Ball shown above. The fact that Hydroforming does not impair the finish of the material is dramatically illustrated here, as these parts are drawn with the plastic coating *still intact!*

CINCINNATI

Deep drawing by the Hydroforming process utilizes a punch working upward into a universal die member—an oil cavity sealed by a flexible diaphragm. Sheet materials are formed to the shape of the punch by controlled hydraulic pressure.

SURFACE FINISH IS UNIMPAIRED

The cushioned action of the flexible die member cannot mar the surface of the material being formed. Parts can be formed *after* the material is painted, plated, lithographed or highly polished.

Conventional drawing methods leave a succession of draw marks on parts produced by two or more draws. The number of draws required to Hydroform a part does not affect the surface finish quality.

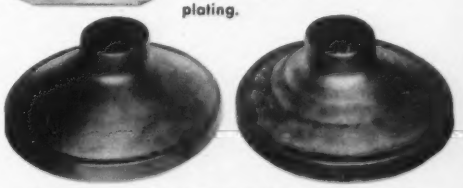
MECHANICAL VALUES ARE IMPROVED

Due to the unique drawing action, Hydroforming retains higher mechanical and physical values in the part. Because the material is uniformly worked during the draw, localized thin-out is either greatly reduced or eliminated. Hydroforming reduces springback, improving the dimensional accuracy of the part.

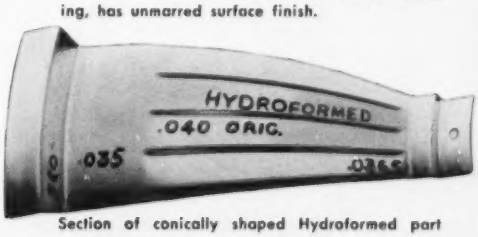
In addition to substantial savings on secondary finishing operations, Hydroform users report improved part quality—greatly reduced tool costs—savings in materials—reduction in the number of required operations on many parts—less time required between release of drawings and the production of part samples—many other benefits. Can *your* manufacturing program use similar economies? Then investigate Hydroforming *now*—it will change your thinking on deep drawing and forming! Contact your nearest Cincinnati Milling Machine Co. representative for full information.

Sterling silver bowl and salt shaker base Hydroformed without scratching or scuffing the extremely soft surfaces. Very little secondary work is required to produce the lustrous finish.

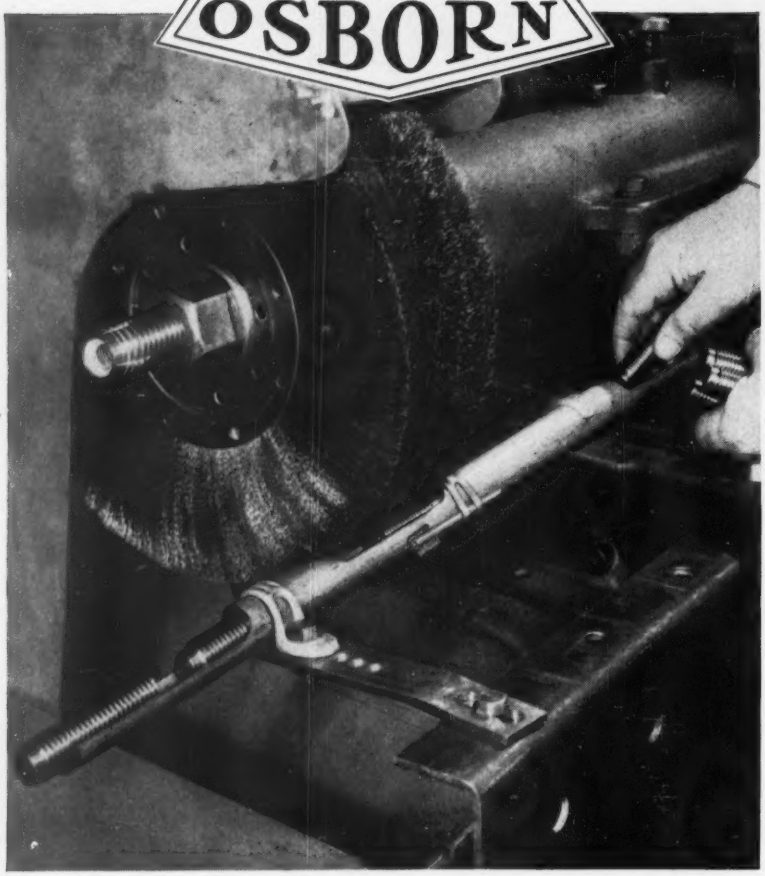
Cuff Link face of gold-plated brass, Hydroformed *after* plating.



Note draw marks on part at right, produced by conventional method in 7 operations. Same part at left, produced in 3 operations by Hydroforming, has unmarred surface finish.



Section of conically shaped Hydroformed part gaged to show reduction of material thickness by forming. Note loss of only 0.005" and 0.0035" in the areas indicated. Identical section of this part produced by conventional method shows from 6% to 25% greater material reduction in same areas.



How to find an 800% production increase in a piece of pipe

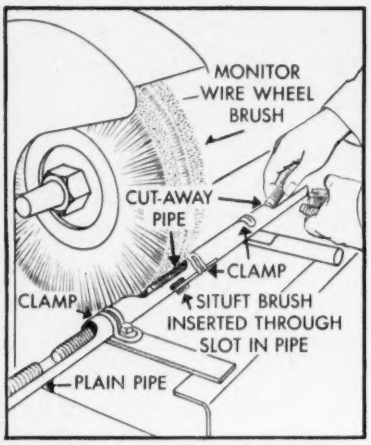
You can save manpower and money in countless ways when you tap the idea resources of power brushing. For example:

It took 18 seconds to clean the threads of the 2½ x ¾-inch set screws shown above. Time was cut to 2 seconds with Osborn Power Brushing by devising the simple pipe fixture shown. The operator feeds the screws in one end of the pipe and an Osborn brush makes contact with the work at a slot cut in the pipe, spinning and cleaning the threads uniformly. A little stationary wire brush, inserted as shown through the pipe, controls rotation and traverse of the work.

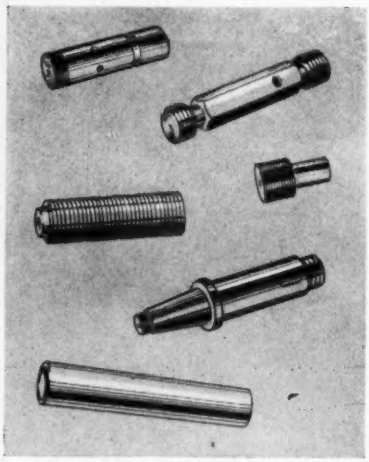
Have your **O**sborn **B**rushing **A**nalyst help you develop and apply output-increasing ideas to *your* cleaning and finishing operations. Call now or write *The Osborn Manufacturing Company, Dept. D-1, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

OSBORN

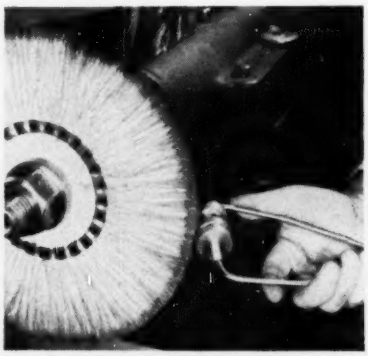
LOOK FOR THE NAME OSBORN . . . RECOGNIZED EVERYWHERE FOR QUALITY WORKMANSHIP AND MATERIALS



THE FIXTURE. This sketch shows how to make pipe fixture for deburring and polishing small parts, threaded or smooth. Can be made of steel, fiber or plastic tubing.



TYPICAL PARTS. Set screws, pins, pieces of tubing and other parts such as these can be cleaned and finished in the pipe fixture or in the forceps shown below.



ANOTHER SIMPLE APPROACH. For small parts such as bushings, a simple forcep fixture can be devised to hold parts for power brushing. This one is made of wire.

Production Pointers from GISHOLT

TIME-SAVING IDEAS

Presented as a service to machine shops, we hope some of these interesting ideas, culled from thousands of jobs, will suggest ways to help you cut time and costs in your own metal work.

SHOWS MODERN TREND IN BALANCING

Machine Balances And Corrects 100 Fans Per Hour

Today, industry *knows* the importance of balancing rotating parts, large and small. It's fast becoming a regular part of production...and *production* balancing more and more is combining the complete balancing process in *one* machine.

It's being done here:

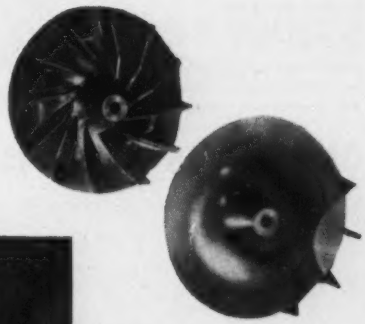
The part is a small fan for a well-known vacuum sweeper. One Gisholt DYNETRIC Balancer with correction equipment as an integral part of the machine, handles the full production—locating, measuring and correcting static unbalance at a rate of 100 fans per hour.

Locating and measuring unbalance is a matter of only a few seconds. The operator then turns the fan to the proper angle and turns a hand-wheel to correspond with the meter reading. At the press of a button, a fly-cutter removes the exact amount of metal to bring the fan into balance.

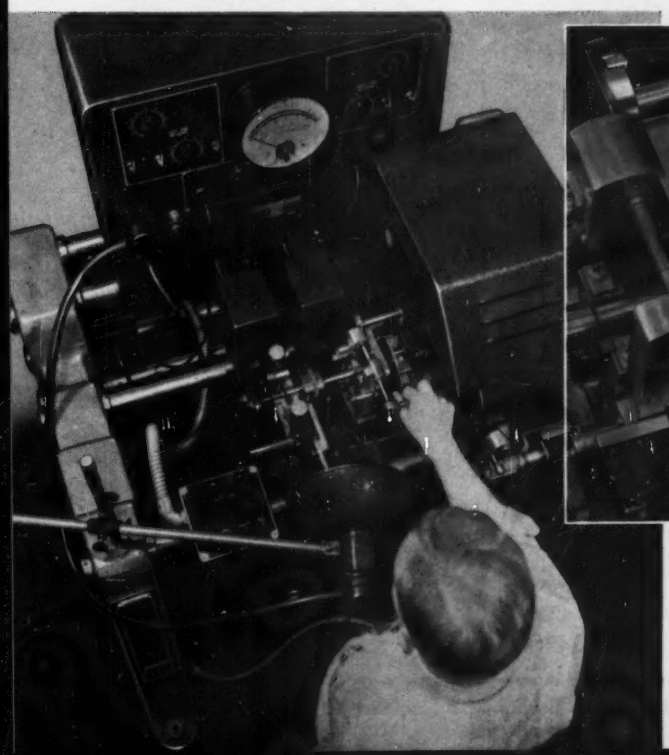
Thus, the *entire* job—locating and measuring unbalance, correction and inspection for over-all accuracy—is done in one operation. It saves handling. Only one loading is necessary.

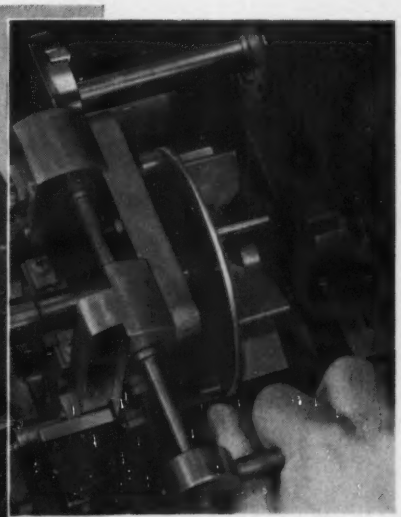
With this entire balancing operation averaging only 30 seconds, the balancing cost is repaid many times by the greater smoothness, quietness and longer life of the fans.

DYNETRIC BALANCERS GISHOLT



▲ Front and back of fan with metal removed to correct unbalance.





▲ Close-up showing method of correcting unbalance by use of fly-cutter.

◀ Gisholt Balancing Machine with integral correction equipment.

HELPFUL INFORMATION on balancing is given in the article, "Static and Dynamic Balancing" from the latest A.S.T.E. Handbook. Will be glad to mail you a reprint.

BALANCING SCHOOL.

Ask for details and starting dates of the Gisholt Balancing School, industry's only complete training program.

GISHOLT

TIME-SAVING IDEAS

HOW CAREFUL PLANNING SAVES 2nd OPERATION

Two-Stage Setup on Simplimatic Provides Answers

Here's ingenuity at work again.

This Simplimatic Automatic Lathe is making real savings in the machining of these 4½" rock bits for oil well drilling. Here's the story:

Loading—Initial alignment is very important. This is assured by a special loading fixture. The bit, complete with cutters, is loaded into the swinging air-operated cup fixture which holds it on the spindle centerline. An air-operated drawbar then pulls the loading fixture against locating stops. The chucking fixture is engaged and the piece is ready for machining.

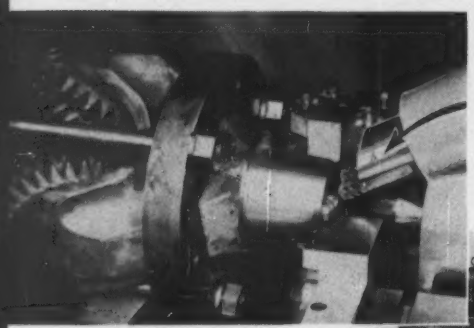
1st Stage—An angular slide moves in to center the bore. With this done, it retracts and the tailstock center comes in to support the shank for the heavy cuts to follow. All this is part of the completely automatic cycle.

2nd Stage—With the center in place, tools on the front slide taper turn the shank, which is made up of three welded sections. Tools on the rear slide chamfer and turn the face.

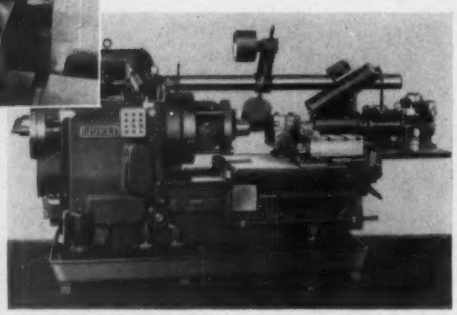
Remember, all this is done in a single automatic operation... and the time is only 2.25 minutes. Production-wise, this Simplimatic (which handles a number of different size bits) is producing at a rate equal to *three* hand-operated turret lathes.

The machining of these parts is reduced to a one-chucking job by the addition of a special tool slide for centering the workpiece.

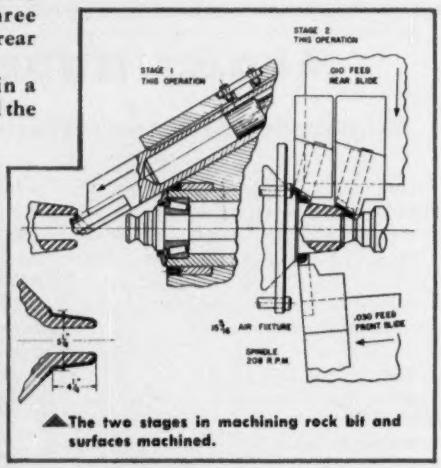
This is just one of 31 interesting jobs shown in the all-new Simplimatic catalog. Write for your copy today.



▲ Close-up of tool slide extended to cut center in bit shank. Slide then retracts and tailstock comes in to support the shank.

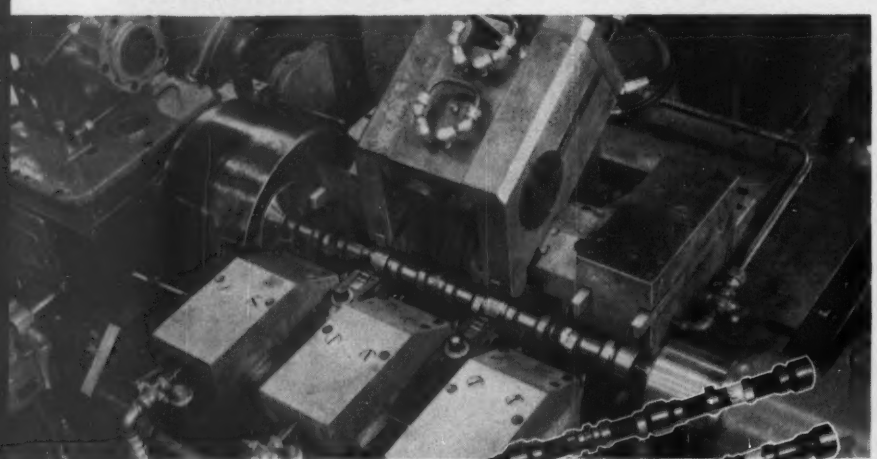


▶ Simplimatic with special tailstock tool slide and swinging fixture for loading and unloading.



▲ The two stages in machining rock bit and surfaces machined.

CAMSHAFTS GET QUICK CLEANUP IN THIS HIGH-PRODUCTION SETUP



Tool setup for camshaft cleanup work. Note top and bottom supports. ▲

▲ Camshaft before cleanup; bottom camshaft after machining.

Uses No. 12 Hydraulic Automatic Lathe

This job, cleanup operations on a six-cylinder camshaft, shows the kind of top speed, highly efficient setup demanded by the automotive industry.

A driver and center hold the forging. To give the long, thin camshafts the support required to prevent distortion and whip, there are two sets of intermediate rollers. The top rollers move in automatically before the cut is started and retract for unloading.

Slides and carriages are tied together in pairs to handle the entire length of the camshaft. The six diameters of the camshaft are turned by tools at the front. Form tools at the rear then plunge cut and clean up. Time per camshaft is 0.4 minute.

The fully automatic cycle of the No. 12 Hydraulic Lathe simplifies and speeds cleanup work on these automotive camshafts.

WHERE C/F TURRET LATHE REALLY PAYS OFF

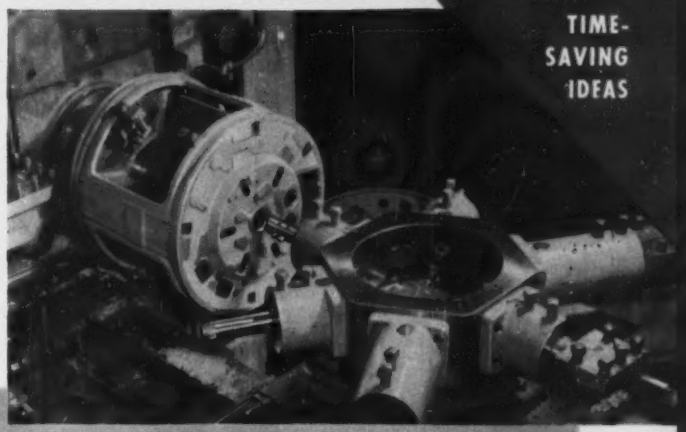
Inside Work Done with Ease

The two problems faced in the machining of these housings were (1) holding of the thin wall part and, (2) back facing the center bore. A special face plate fixture with draw-back clamps provided the careful chucking answer.

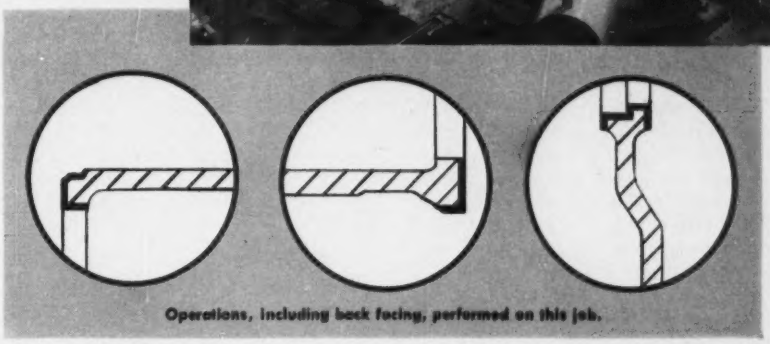
As for machining, the job might well have involved several operations with special tooling. However, the 2L Saddle Type Turret Lathe with its cross-feeding turret solved this problem. With the sliding hexagon turret, simple standard tools handle a number of different surfaces, including the back face and counterbore shown at the right in the drawing. Moreover, by doing the job in one chucking, concentricity is assured on the many different diameters.

With the cross-feeding turret, you can feed both laterally and longitudinally. Thus you can use simple tooling and can quickly change over to other types of work.

Simple tooling, plus the cross-feeding turret of this Saddle Type Lathe, add up to big savings on this interesting job.



Simple setup for machining awkward, thin-wall part.



Operations, including back facing, performed on this job.

GOOD TURRET LATHE SETUP FOR SMALL BRASS PARTS

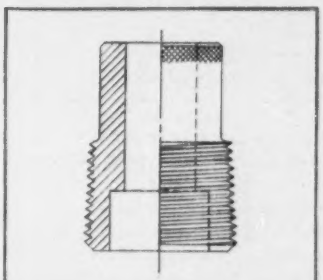
Ram Type Lathe Handles Parts in 5 Sizes

Here's a business-like setup for machining cast-brass plug bodies on a No. 3 Ram Type Turret Lathe. Held on the inside hex diameter by special jaws on an aluminum chuck, a combination turning, boring and facing tool on the first station does the bulk of the work.

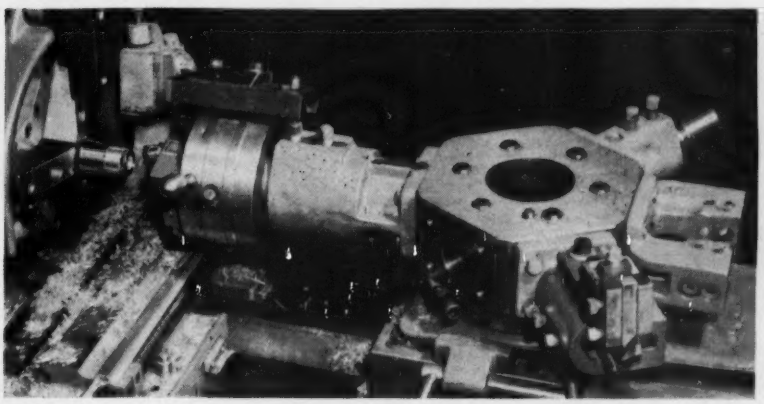
Knurling follows at the next station with the required rough finish put on 450 f.p.m. The third station is merely a revolving center which supports the end while a shave tool on the rear of the cross slide forms the taper O.D. At the last station, the taper is threaded by a special self-opening die head.

On a test run, this plug was machined in 0.84 minute, floor-to-floor. In addition, four other sizes, ranging from 1¾" to 2⅜" O.D. are handled.

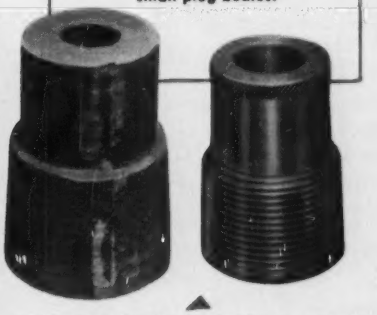
This user is time ahead by a fine job of tooling and a fast ram type lathe.



Work performed on the small plug bodies.



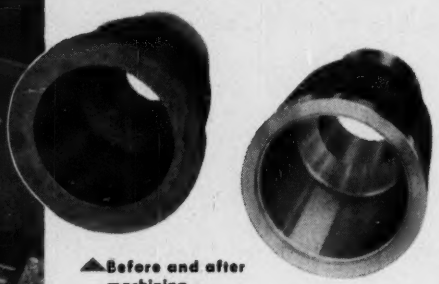
Final operation on the cast plug body is threading the taper.



Before and after view of cast-brass plug body.

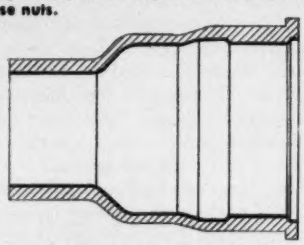
TIME-SAVING IDEAS

JOB SWITCHED TO FASTERMATIC— *PRODUCTION DOUBLED*



▲Before and after machining.

◀Simple setup for first operation on propeller nose nuts.



Heavy lines show surfaces machined by Fastermatic.

Complicated Form Machined with Ease

There was a 140% speedup in first-operation machining of these propeller nose nuts when the job went to the Fastermatic Automatic Turret Lathe. Time now is 5.0 minutes as against 12 minutes on a hand-operated machine.

The drawing shows the many surfaces to be handled. Working at five separate feeds, conventional tools rough and finish bore, turn and face. Doing the taper bore is a simple matter with the help of a turret facing attachment guided by a cam bar on the rear independent slide. A necking tool operated by an overhead stop bar does the recess in the bore.

Other advantages of the Fastermatic for this job are that no further finishing is required and its repeat accuracy has virtually eliminated spoilage.

Using standard tools, and in a continuous automatic cycle, this Fastermatic cuts tool costs and machining time in first operation work on these parts.

Good News on Deliveries! Production has been stepped up again on 1F and 2F Fastermatics. Check your requirements with your Gisholt representative now.

COST-SAVING IDEA FOR SUPERFINISHING

Mounts on Lathe to Provide Better Surfaces at Lower Cost

This beam flange for textile equipment is a far better product since Superfinishing has a part in its making. Yet, the investment in Superfinishing equipment is surprisingly low...the manufacturer simply mounted a Superfinish Attachment on the tool post of his engine lathe.

Formerly, the flange face was turned and then ground. Now, grinding has been eliminated and Superfinishing gives him a far better surface...in less time and at lower cost.

With a lathe-mounted Superfinish Attachment, this user is gaining important savings in grinding time while getting better, smoother, longer wearing surfaces.

Large flange surface being Superfinished by lathe-mounted Superfinish Attachment.

Have your copy? The book, "Wear and Surface Finish" has all the facts and information on Superfinish. It's yours for the asking.

No. 1-253

604

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

ALL TOP PERFORMERS ...ALL 100% INSPECTED ...ALL BUTTERFIELD!

Taps, Dies, Reamers, Screw Plates . . . and now Twist Drills . . . round out the cutting tool line that gets industry's unqualified approval for uniform accuracy and long, trouble-free service. Union Twist Drill Company, BUTTERFIELD DIVISION, Derby Line, Vermont. *In Canada:* Rock Island, Quebec.

BUTTERFIELD

THE 100% INSPECTED TOOLS

Every Tool Individually Inspected

TAPS • DIES • REAMERS • SCREW PLATES • TWIST DRILLS

Checking pitch diameter, thread form and lead on a Zeiss Universal Measuring Microscope.

SEE YOUR NEARBY BUTTERFIELD DISTRIBUTOR FOR PROMPT DELIVERIES AND SERVICE

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SHIM PROBLEM
Get the right,
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SHIM
COMPANY, INC.
"SHIM HEADQUARTERS" SINCE 1913
Shim design is modern design. It saves precious, extra, needed hours of machining parts to needlessly close tolerances.
Today the pressure is on speed. Production lines must move fast. Machine time has to be reduced. Two seconds with a shim can save two hours with a machine. Without sacrifice of quality in your end product.
So — when you face a shim situation, it will pay you to check with "Shim Headquarters." Don't just buy a stamping when you need a shim. Our engineering service can be important to you.
ONLY LAMINATED SHIM OFFERS YOU ALL 5
SEND TODAY FOR LITERATURE!

ONLY LAMINATED SHIM OFFERS YOU ALL 5 SOLUTIONS

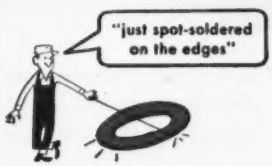
Here's a quick picture of the shimming methods which are at the disposal of designer and production engineer. In actual use, many factors affect choice of proper type, for shim engineering has become a science unto itself. Be sure you check with us for an impartial recommendation. Remember that only The Laminated Shim Company offers you all 5 types of shims.

THE LAMINUM® SHIM

SIMPLY PEELS FOR ADJUSTMENT

The LAMINUM® Shim is made up of layers of .002 or .003 inch brass or steel, metallically bonded together over their entire surfaces. Peeling laminations with a penknife gives simple, accurate adjustment; no counting or miking is necessary. Shim is rigid, easy to handle, less compressible than solid metal. No grit can lodge between layers. Available in from 3 to 63 laminations.

THE LAMISOL* SHIM



FOR QUICK, ASSEMBLY LINE USE

The laminations of the LAMISOL Shim (in brass only) are joined by spot-soldering. This type of shim is just right for high speed, repetitive assemblies, regardless of the shim size involved. Spot-soldering makes a very firm "pack," but the laminations are quickly removed. Laminations within the same shim do not need to be all the same gauge, nor is the maximum number of layers limited.

THE LAMITAB* SHIM

FOR SUPER SPEED, THIN GAUGE SITUATIONS

The LAMITAB Shim is a patented exclusive developed by us for the extremely fast moving production line. The little tab holds the shims together firmly, yet is easily removed. Different metals can be used in the same shim. The LAMITAB Shim is unsurpassed. cost-wise and time-wise when properly engineered. Maximum number of laminations is 4, to a total thickness of .010 inch.

THE LOOSE LEAF SHIM

FOR UNLIMITED FLEXIBILITY

The loose leaf shim is the simplest of all custom-stamped shims. It is completely flexible. There is no limit on number or gauge of each shim — and an occasional situation will require this "wide open" adjustment. In such cases, sets incorporating a variety of gauges are made up. Then, by removing one gauge and inserting another, a full scale of fine gauge adjustment is made possible.

PACKAGED SHIM STOCK

READY FOR EASY USE, WITHOUT WASTE

Our Packaged Shim Stock is available for maintenance work from your Industrial Distributor. 6" x 100" roll feeds through package slots, *as it's used*. Available in 11 gauges, from .001 to .010", brass and steel. Heavier gauges to .032 are packed flat, two 6 x 25" sheets to an envelope. Laminated shim stock for maintenance use is also available in a variety of thicknesses and lamination arrangements.

*T.M. Applied For

ONLY LAMINATED SHIM OFFERS YOU ALL 5

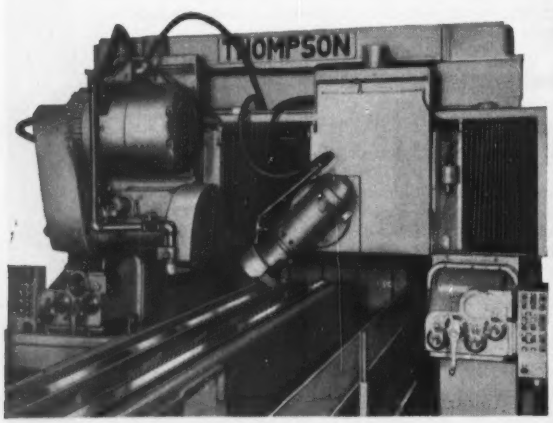
LAMINATED SHIM COMPANY, INC. 3001 UNION STREET, GLENBROOK, CONN.

New Thompson Way Grinder Developments

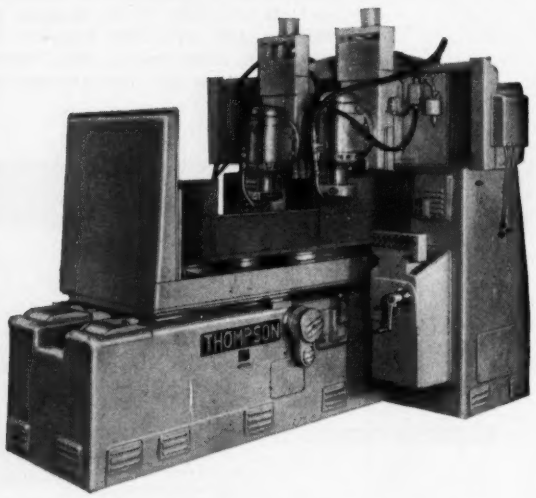
Reduce Costs ... Speed Machine Tool Production

Way Grinders now available with single, multiple heads, or combinations of horizontal and vertical heads and in sizes to meet all requirements.

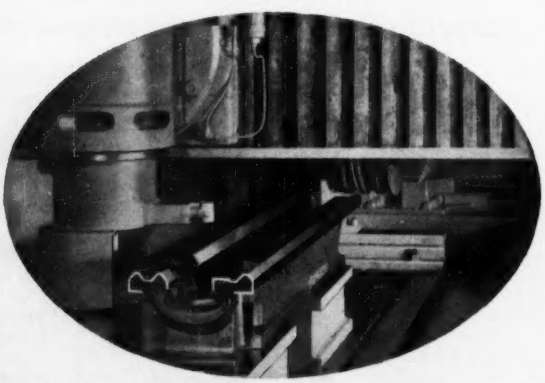
Thompson has produced machine tool way grinders in many types and sizes that have eliminated hand-work and produced economical and accurate ground ways. However, recently increased production grinding of ways has been made possible by many new Thompson Way grinding developments such as: automatic grinding and truing cycles; dual vertical or horizontal heads for grinding ways different heights; horizontal multi-wheel grinding and vertical side and undercutting head; Hydrail way grinding for giant columns or bed ways. Three of the new Thompson Way Grinders are shown here.



Designed especially for extremely large machine tool way grinding is this typical Thompson Hydrail Way Grinder. Size 48" x 48" x 192". Part: grinder bed ways.



One of several new Thompson Double Head Dovetail Way Grinders installed to speed work and hold accuracy in the plant of a leading lathe manufacturer.



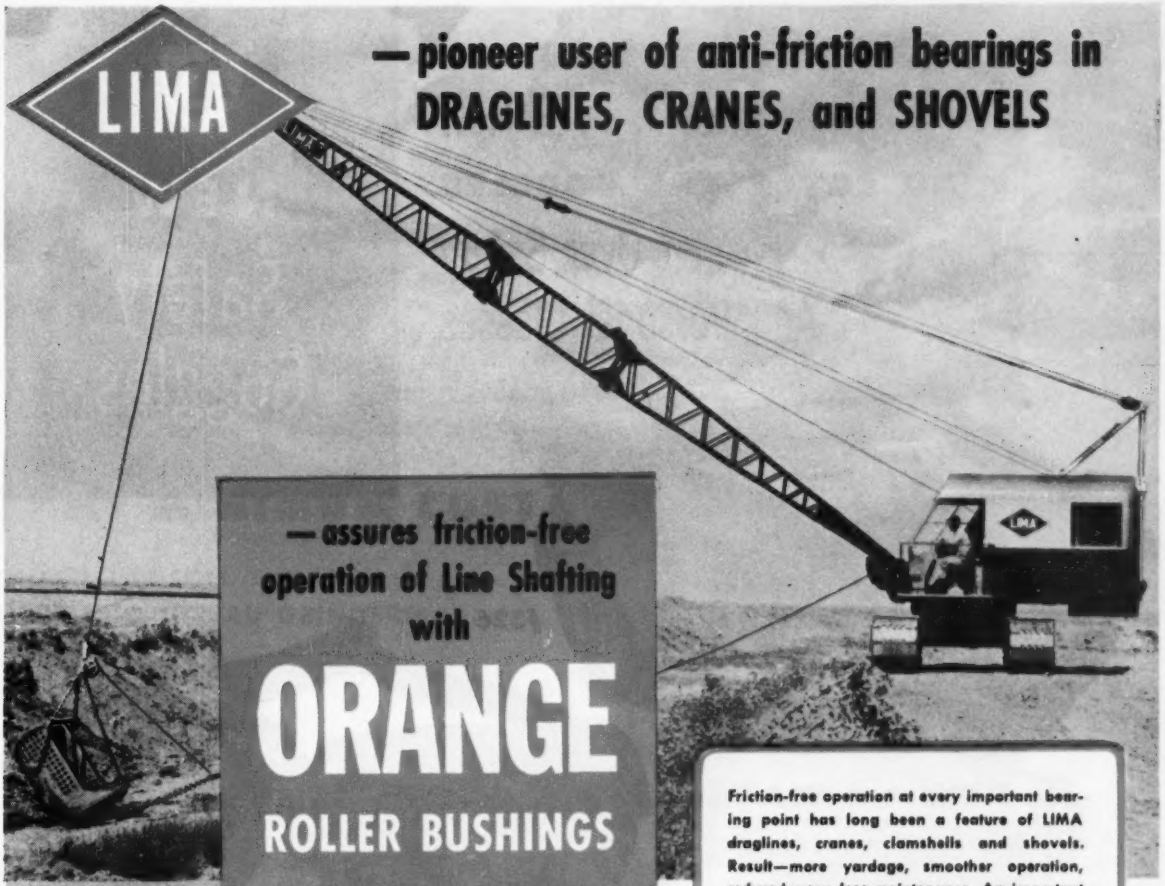
Multi-wheel grinding with auxiliary vertical head. Equipped with horizontal spindle having dual spaced wheels and auxiliary inclinable spindle. The front contoured grinding wheel grinds the rear set of ways and the rear grinding wheel grinds the front set, with vertical head grinding the sides and undersurface of the ways and rack seat.

Write for details Today.

The Thompson Grinder Company, Springfield, Ohio

Thompson SURFACE Grinders

Copyright 1952—The Thompson Grinder Co.

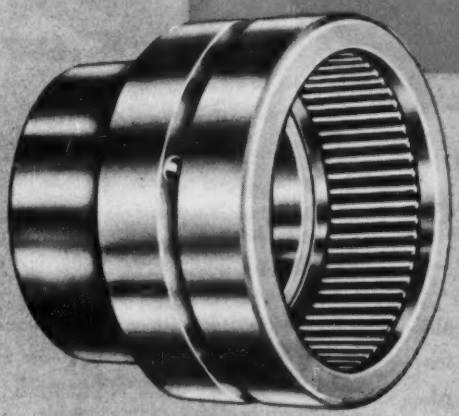


—pioneer user of anti-friction bearings in DRAGLINES, CRANES, and SHOVELS

—assures friction-free operation of Line Shafting with

ORANGE ROLLER BUSHINGS

Friction-free operation at every important bearing point has long been a feature of LIMA draglines, cranes, clamshells and shovels. Result—more yardage, smoother operation, reduced wear, less maintenance. An important contribution to this friction-free designing, is the use of Orange Roller Bushings in the line shafting of many models, to eliminate friction and wear under heavy shaft loads.



Like LIMA engineers, hundreds of others have found it pays to friction-proof rotating or oscillating parts with Orange Roller Bushings. Whether it's an 8″ shaft or a small gear box—heavy load or high speed—Orange Roller Bushings are the most compact, economical, long-life protection for critical wear spots.

Orange Roller Bushings provide exceptionally high load carrying capacity in small space. They stand up in heaviest equipment, yet are precision-running to satisfy the most exacting requirements. Extreme precision standards provide closer internal running clearances, which minimize possibility of misalignment of rollers.

- Orange Roller Bushings are available in a full range of sizes from ½″ to 8″ shaft diameters. Also double and triple row types for special applications.
- Send drawings or details of needs for suggestions. Engineering representatives are conveniently located to work with you on any bearing installation.

Write for Engineering Data Book showing sizes, capacities, installation data, etc.

ORANGE

ORANGE ROLLER BEARING CO., Inc. 552 Main St., Orange, N. J.

Now . . . 2 New
AO COVERGLAS GOGGLES
Fit Over Safety And Personal Glasses

NEW
Safety Goggles

#326

#327

NEW – 4 WAYS!

1. New Cup Size and Shape
2. New Lens Size and Shape
3. New Side Shields
4. New Easy Lens Replacement

AO's newest development in eye protection—Chippers' and Welders' Coverglas Goggles—can be worn over practically every pair of personal glasses (even the biggest frames) and most types of safety prescription goggles *with and without side shield.*

Wider vision, too, because the lenses are larger and scientifically designed to give up to 20% more vision. Yet, with all these features the goggles weigh but a fraction of an ounce more than ordinary Coverglas goggles . . . cost only slightly more.

These goggles are the newest . . . and two of the greatest . . . developments since the advent of safety goggles. Get all the facts about these two outstanding Coverglas goggles from your AO Safety Products Representative. He can supply you.

QUICK FACTS

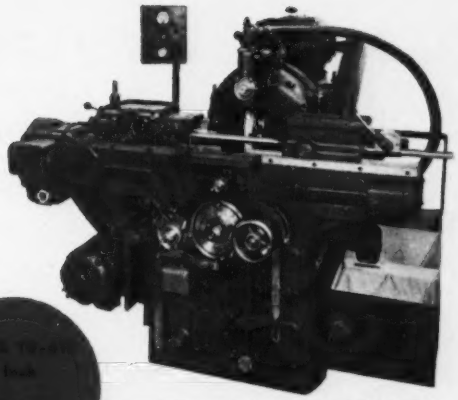
- Lens easily replaceable from rear (not front) by means of a spring clamp—no tools needed
- Lightweight, brown plastic cups fit face snugly, won't conduct heat or electricity
- Light-tight side shields for welders (on No. 327 goggle) provide indirect ventilation
- Bridge—High-grade leather. Instant adjustment
- AO worker-lab tests show much greater field of vision and increased comfort
- All-rubber headband, easily adjustable

"326" Chippers' Coverglas goggle supplied with regular Super Armorplate lenses. "327" Welders' Coverglas goggle supplied with regular Noviweld lenses and cover lenses.

AO's Industrial Vision Program Increases Production, Decreases Accidents. Write today for booklet "Improved Industrial Vision" to 1011 Vision Park, Southbridge, Mass.

American Optical COMPANY
SAFETY PRODUCTS DIVISION

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES

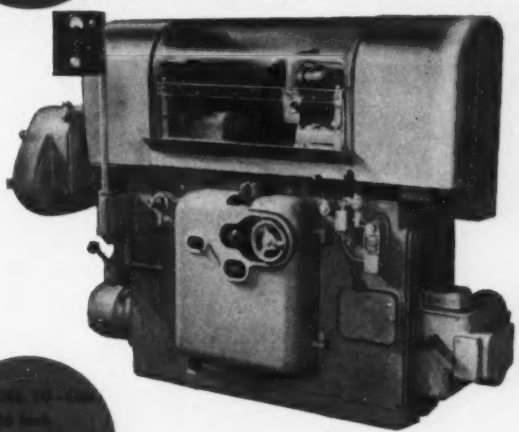


Quality threading
AT MINIMUM COST

The 6 x 18 Automatic Thread Grinder is used for high production thread grinding with either single or multi-ribbed wheels on relatively small parts.

JONES & LAMSON
AUTOMATIC THREAD GRINDERS:

- Produce threads of better quality and more uniform finish
- Reduce handling cost
- Eliminate costly rethreading after heat treatment
- Eliminate expensive retooling when specifications change
- Reduce cost of gage maintenance



The 6 x 36 machine is extremely versatile and is used as long as short run jobs on a great variety of precision threaded parts. Single or multi-ribbed wheels may be used.

Built-in accuracy and automatic features, make any of these machines a paying investment for toolroom or production line.

- Automatic wheel truing
- Automatic infeed on successive cuts
- Automatic sizing
- Rheostat wheel speed control
- Diamond or crush dressing of wheels
- Multi-ribbed threading
- Right and left hand threading

The 12 x 48 machine is used for grinding threads on a wide range of work from small to large heavy parts. Single or multi-ribbed wheels can be used.

When measuring the value of a thread grinder remember the extra benefits of J&L top-flight construction. Write Dept. 710 for illustrated catalog.

JONES & LAMSON

Machine Tool Craftsmen Since 1835

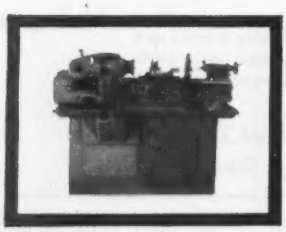
JONES & LAMSON MACHINE CO., 512 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

THREAD GRINDER DIVISION

...another product from the plant of precision!

9" x 24" Tool and Gage-Makers' Lathe with Electronic Motor Control

Now you can have the advantages of quiet, simple, modern Hendey Electronic Motor Control on the Hendey 9" x 24" Tool and Gage-Makers' Lathe. These advantages include stepless spindle speeds from 25 to 3000 R.P.M. by potentiometer control of both field and armature of the 3 H.P. d-c motor. Exceptionally close speed control is obtained even under changing load. I.R. compensation gives full torque at low speeds over the complete armature control range. A full stop from maximum speed is accomplished in approximately 1½ seconds. Starting, stopping or reversing, even at 3000 R.P.M., is accomplished smoothly and rapidly. This new drive is optional equipment, and full information is available in our new 9" x 24" Lathe catalog. Write for your free copy! It gives full details on the new drive as well as other features of the Hendey 9" x 24" Lathe, which guarantee precision output with minimum effort.



MODERN Hendey

THE HENDEY MACHINE CO., INC.
MAIN OFFICE & PLANT: TORRINGTON, CONN.
BRANCH OFFICES: New York, Chicago, Boston, Detroit, Rochester, Los Angeles, San Francisco
REPRESENTATIVES: Philadelphia, Cleveland, Pittsburgh

New OILTIGHT LIMIT SWITCHES

Here is a new line of remarkably compact Allen-Bradley limit switches . . . streamlined for fine appearance and built for millions of failure-free operations.

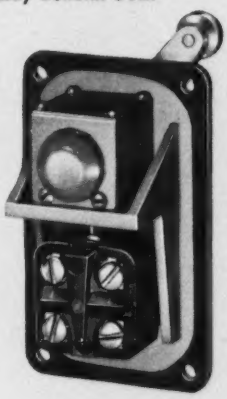
The operating heads of these limit switches may be attached to the switch body in four definite locations, each 90 degrees apart. A large selection of pushrods, lever arms, and other actuating mechanisms is available.

The name plate cover has a synthetic rubber gasket to exclude oil. Terminals are easily accessible by removing the cover plate. The body is threaded for ½" conduit. The switch mechanism is snap-acting, with one single pole normally open and one single pole normally closed contact, electrically separated.

The new Bulletin 802 limit switches are designed for machine tool applications. For further information send for a copy of Allen-Bradley Bulletin 802.

Bulletin 802 limit switch with roller lever

Roller lever type (Front View) for cavity mounting in machine frames



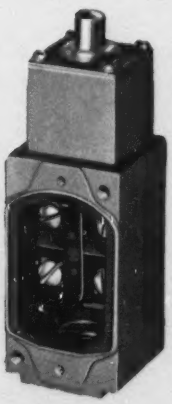
Roller lever type (Rear View) showing terminals for n.o. & n.c. contacts

ALLEN-BRADLEY QUALITY
LIMIT SWITCHES

A-B Quality

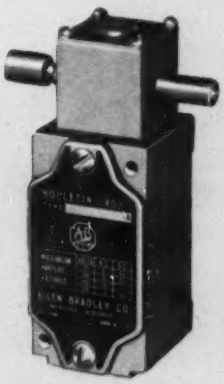
Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wisconsin

Pushrod limit switch with roller for vertical motion of the pushrod

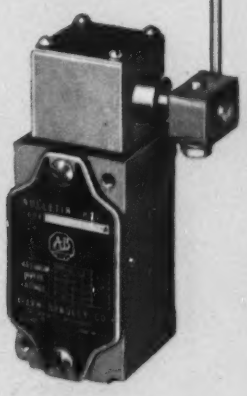


Pushrod limit switch without roller—cover off to show terminals

Pushrod limit switch designed for horizontal motion of the pushrod



Pushrod limit switch with side pushrod and maintained contacts



Lever operated limit switch with a long and flexible operating rod

1-53-MR

Extra! Handy Auxiliary Contacts

for all Allen-Bradley Sizes 0 and 1 Solenoid Controls

Contact may be reversed by removing one screw

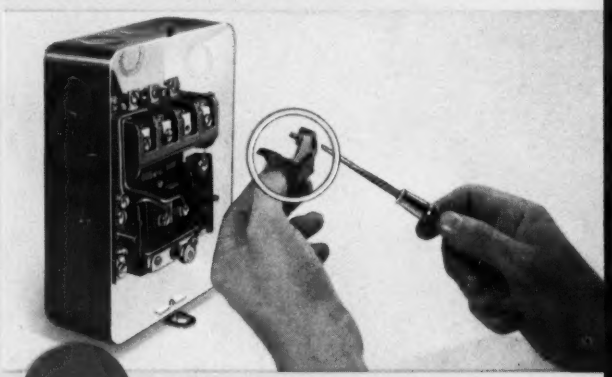
Do you want to add one or more extra pilot contacts to some of your Allen-Bradley solenoid switches . . . to operate indicator lights, relays, or other starters?

These new, compact auxiliary contacts can now be added to the arc hood of any and all standard sizes 0 and 1 solenoid switches. The operating arm of the auxiliary contact is actuated by the up and down motion of the solenoid plunger of the switch to which it is attached.

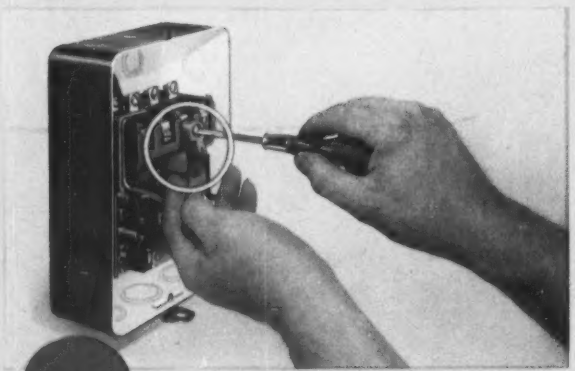
Write for descriptive literature.

SO SIMPLY APPLIED

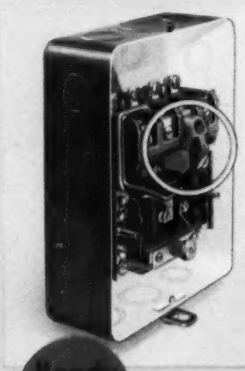
First Remove the terminal screw from the stationary contact block of the Allen-Bradley starter.



Second Insert terminal screw into mounting hole of auxiliary contact to be attached to starter.



Then Screw terminal screw into stationary contact block and fasten auxiliary contact to starter.



Auxiliary Contacts easily changed from n.o. to n.c. operation

The new Allen-Bradley auxiliary contact may be instantly changed from n.o. to n.c. contacts. Removal of one screw permits the instant reversal of the contacts in the contact block. There are no small parts to lose.

Ready to Wire Allen-Bradley auxiliary contact is now ready to be wired for any auxiliary pilot circuit.

1-53-MR

These auxiliary contacts are available for all Allen-Bradley sizes 0 and 1 controls, including contactors, reversing switches, combination starters, Bulletin 709 solenoid starters, and Bulletin 609 manual starters.

Allen-Bradley Co., 1316 S. Second St.
Milwaukee 4, Wisconsin

ALLEN-BRADLEY

SOLENOID CONTROLS

Williams' Titan Crusher served by custom-built Farval centralized system

THE lubrication problem was this: How to keep the rotating spindle bearings on the novel crusher (at right) working dependably and efficiently in an important ore preparation plant.

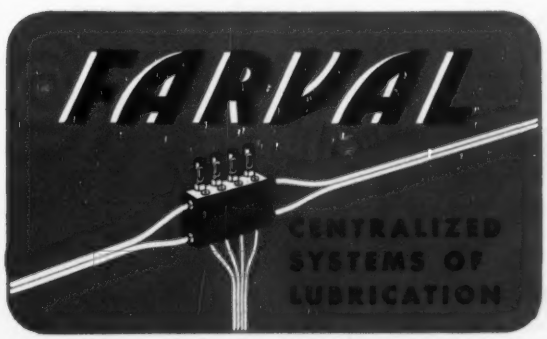
The plant engineers knew that pulverizing and crushing stubborn flint-like ore creates tremendous bearing pressures and that meant that constant lubrication care was a must. They also knew that getting a lubrication system onto a rotating portion of a machine had always presented a ticklish problem. Yet, to stop the machine for guess-and-by-gosh hand oiling meant production hours wasted and, at best, a hit-or-miss lubrication job.

To cope with the special problems presented by this ore crusher, Farval engineers were called in and soon came up with a modern custom-built solution for lubricating constantly moving bearings. In a unique rotating connection and by means of tough, flexible hoses and a reversing element, the Farval Centralized Lubrication System was tailored to body-fit the gyrating portions of the crusher. This practical approach to machine preventive maintenance saves time and men, saves lubrication (as high as 75%) and most important, increases production.

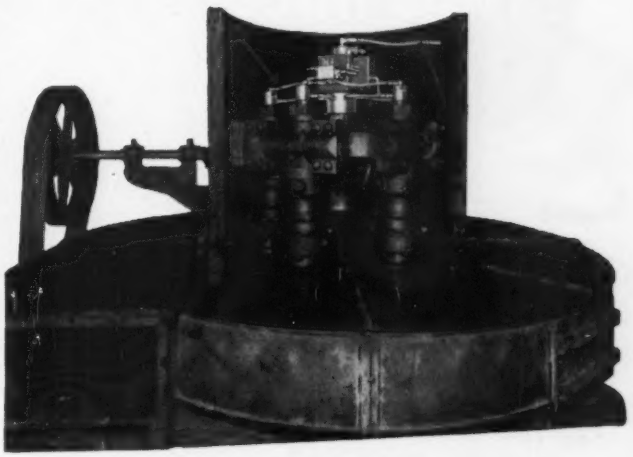
Farval has proven itself in 25 years of service to industry. It is the original Dualine system of centralized lubrication. The Farval valve has only two moving parts —is simple, sure and foolproof, without springs, ball-checks or pinhole ports to cause trouble. Through its wide valve ports and full hydraulic operation, Farval unfailingly delivers grease or oil to each bearing—as much as you want—as often as desired. Indicators at every bearing show that each valve has functioned.

In or near your city, there is a Farval engineer ready to serve you with your special or conventional lubrication problems. Write now for Bulletin 25 and a full description of the Farval system at work. The Farval Corporation, 3276 E. 80th St., Cleveland 4, Ohio.

Affiliate of The Cleveland Worm and Gear Company, Industrial Worm Gearing. In Canada: Peacock Bros. Ltd.



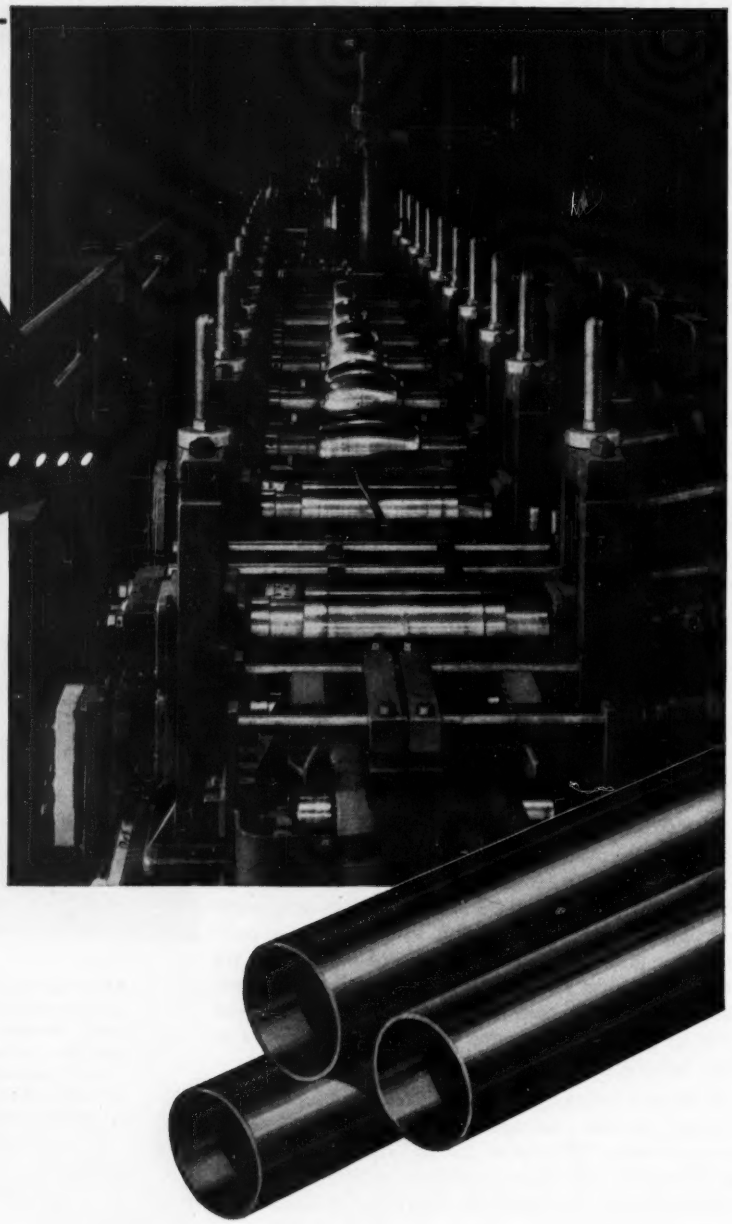
FARVAL—*Studies in Centralized Lubrication*
No. 135



KEYS TO ADEQUATE LUBRICATION— *Whenever you see the sign of Farval—the familiar valve manifolds, dual lubricant lines and central pumping station—you know a machine is being properly lubricated. Farval manually operated and automatic systems protect millions of industrial bearings.*

Illustration by courtesy of Williams Patent Crusher and Pulverizer Co.

One of several YODER TUBE MILLS recently installed by leading Auto Manufacturers—



The Choice of a TUBE MILL....

may be governed by a great many factors such as first cost, operating cost, speed, capacity, power consumption, etc. Mechanical and electrical features of the tube forming, sizing and welding units in themselves must be carefully examined. However, no matter how necessary or important all such details may be—or how effectively they may be presented—the most convincing proof of superiority is obtained by a comparison of tonnage production, consistently maintained over the years, of high quality tubes.

Fortunately, most electric weld tube mills are chosen that way. This fact, above all others, explains why the vast majority of such mills installed in the U.S.A. are built by Yoder.

List of Yoder tube mill installations sent on request. Also literature discussing the economics as well as the mechanics of tube making.

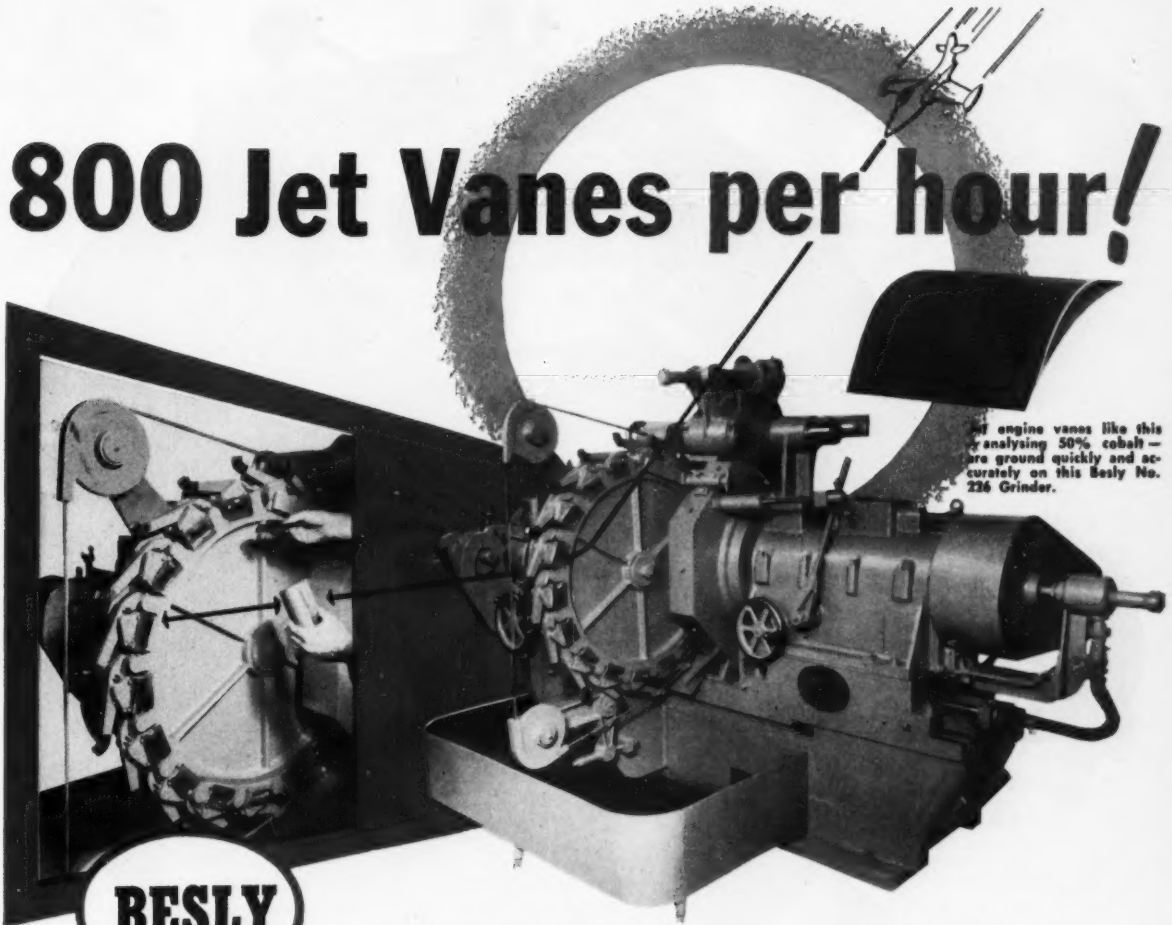
THE YODER COMPANY
5504 Walworth Avenue • Cleveland 2, Ohio

Complete Production Lines

- ★ COLD-ROLL-FORMING and auxiliary machinery
- ★ GANG SLITTING LINES for Coils and Sheets
- ★ PIPE and TUBE MILLS—cold forming and welding

ENGINEERING YODER MANUFACTURING

800 Jet Vanes per hour!



...f engine vanes like this ...r analysing 50% cobalt — ...re ground quickly and ac... curately on this Besly No. 226 Grinder.

BESLY

Each of two No. 226-30" Double Spindle Grinders turns out approximately 800 jet vanes per hour, removing 1/16" and .010" of stock respectively on rough and finish grinding. Each Grinder has a rotary unit and feed wheel with 18 work stations. Blades are loaded by hand, then automatically located and clamped by a cable clamping mechanism. After passing between abrasive wheels where stock is removed from both ends, the work is partially ejected from the station and unloaded by hand.

Jet Engine Vanes ground at high production rate on BESLY 226 Double Spindle Grinders

Important savings are effected in material, weight and cost of production by fabricating Jet Engine Vanes from heat resistant alloy sheet which is formed and welded to the required airfoil.

The above illustration shows one of two Besly No. 226-30" double spindle grinders employed to rough and finish grind the ends of the Jet Engine Vanes. The two open ends of the vanes are ground simultaneously by passing between two parallel abrasive wheels where approximately 1/16" of stock is removed from each end.

Every 4½ seconds a finished ground vane is delivered from these grinders. The difficult fixturing problem of locating and clamping the unusual form was solved with typical Besly skill and ingenuity.

The problem of eliminating heat distortion and burning when grinding tough, thin-wall material was solved by the use of a highly efficient coolant system and the proper abrasive wheels.

This is another example of results achieved when Besly experience applies Besly grinders — either basic, with adaptation or specially engineered — to practically any grinding operation.

If you have a grinding need or problem that's hard to crack, talk to the Besly representative in your territory. Or—send the coupon below for more information.

BESLY-WELLES CORPORATION
Established as Charles H. Besly and Company in 1875.
112 Dearborn Ave. BELOIT, WISCONSIN

BESLY

BESLY GRINDERS and ACCESSORIES
BESLY TAPS, DRILLS, REAMERS
BESLY-TITAN ABRASIVE WHEELS

BESLY-WELLES CORPORATION
112 Dearborn Ave.
Beloit, Wisconsin

☐ Please send us bulletin of detailed information on Besly No. 226 Grinders.

☐ Also have a representative call.

Name_____

Company_____ Position_____

Address_____

City_____ Zone____ State_____

Nichols TOOL ROOM MILLER

Accurate

Sensitive

Versatile

A compact, rugged miller that gives the tool room what it demands—extreme accuracy and utmost flexibility. The NICHOLS TOOL ROOM MILLER is arranged for sensitive hand screw feed. It has generous table surface of 8½" x 30", with 19" longitudinal travel. Precision feed screws are fitted with oversize, easy-reading micrometer dials. Large hand wheels provide the element of "feel" so important in precision milling. Rise-and-fall spindle enables easy handling of many difficult operations—increases usefulness—simplifies set-ups. Readily available are dividing head, vertical attachments, vises, and a full line of milling accessories. Priced surprisingly low. Descriptive literature sent on request.

MANUFACTURED BY W. H. NICHOLS COMPANY, WALTHAM, MASSACHUSETTS

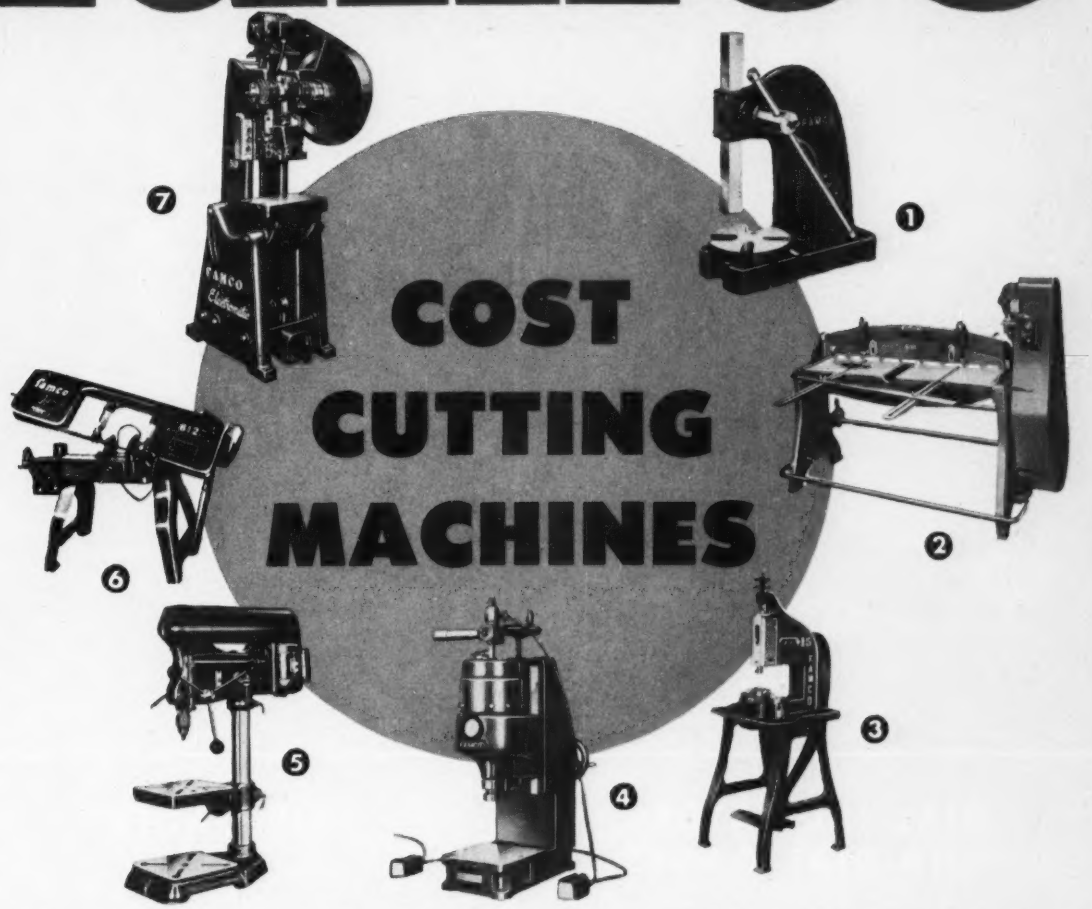
NATIONAL DISTRIBUTORS

NICHOLS-MORRIS CORPORATION

76-E MAMARONECK AVE. • WHITE PLAINS, N. Y.

NIEMI · NADEL

famco



1 **ARBOR PRESSES,** 32 stock models—plain lever, simple ratchet, combination compound and simple ratchet—bench and floor types. Front and side gib adjustments maintain perfect alignment. Deliver up to 15 tons pressure.

2 **POWER AND FOOT SQUARING SHEARS,** 8 ruggedly-built models shear up to 18 gauge mild steel; available in cutting widths 22 to 52 in. Power models feature non-repeat mechanism, easily set for continuous operation.

3 **FOOT PRESSES,** sturdily constructed of semi-steel for ease and speed of operation; precision-machined for long, trouble-free operation. Foot presses are available in 10 bench and floor models. Deliver up to 3¾ tons pressure.

4 **AIR PRESSES** are built especially for heavy, continuous industrial operation. Compact, rugged in design, they are available in 20 models, bench or floor types, ½ to 3½ tons capacity, with built-in electric or air controls, single or dual type.

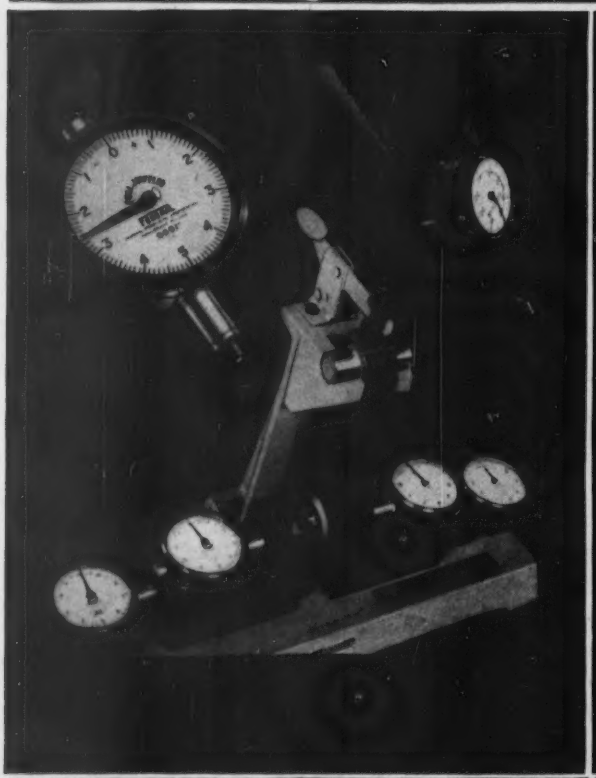
5 **DRILL PRESSES,** available in 28 models of 15" presses in single and multiple spindle; tilting table and production models, bench and floor types. Rugged in construction and built throughout for long years of dependable service.

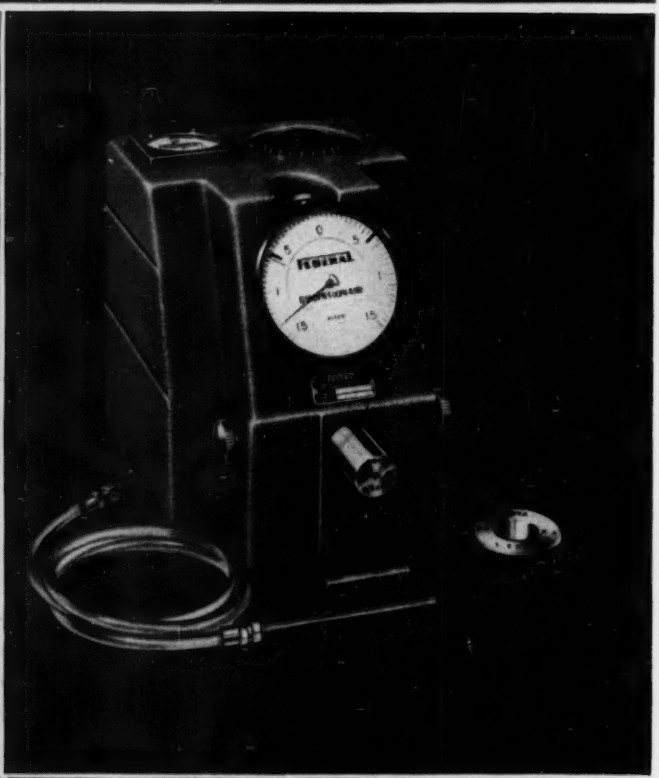
6 **BAND SAWS,** built like finished machine tools in every sense; available in 4 models of horizontal cut-off saws for dry or wet cutting, with or without coolant system. Capacity: 6" round and 6" x 12" rectangular stock.

7 **POWER PRESSES,** Open-back inclinable, standard and deep-throat production models, are offered in 13 bench and floor models; rated from 3 to 18 tons capacity. New Model 59 features the exclusive Famco "Electromatic" clutch, the revolutionary, electrically controlled jaw clutch.

FAMCO MACHINE COMPANY

Keep Modern with



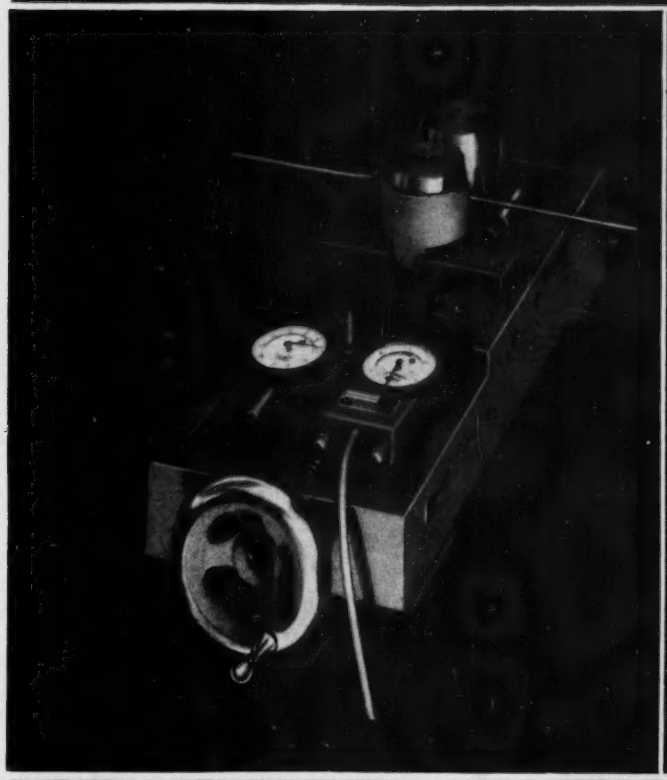


DIAL INDICATORS AND DIAL GAGES

AIR GAGES

Largest manufacturer devoted exclusively to designing and manufacturing *all types* of DIMENSIONAL INDICATING GAGES

FEDERAL GAGES



CONTINUOUS-MEASURING GAGES

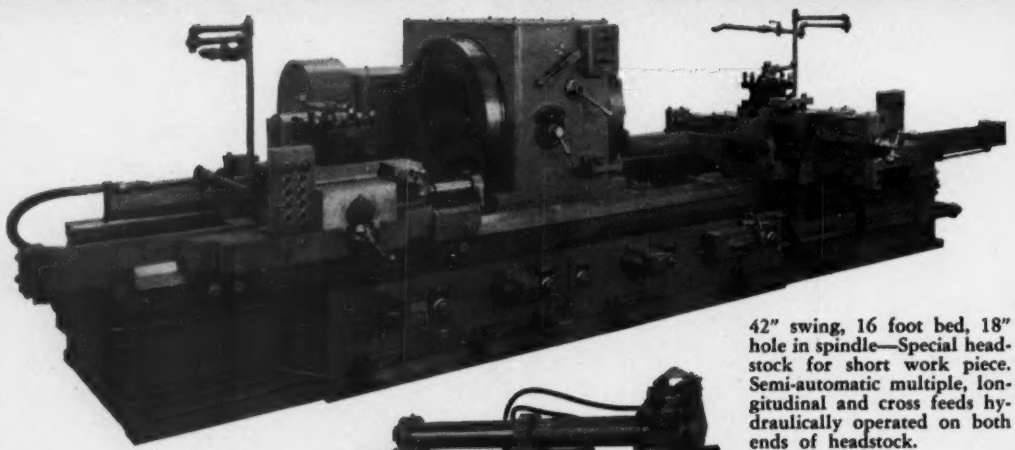
AUTOMATIC SORTING GAGES

FEDERAL

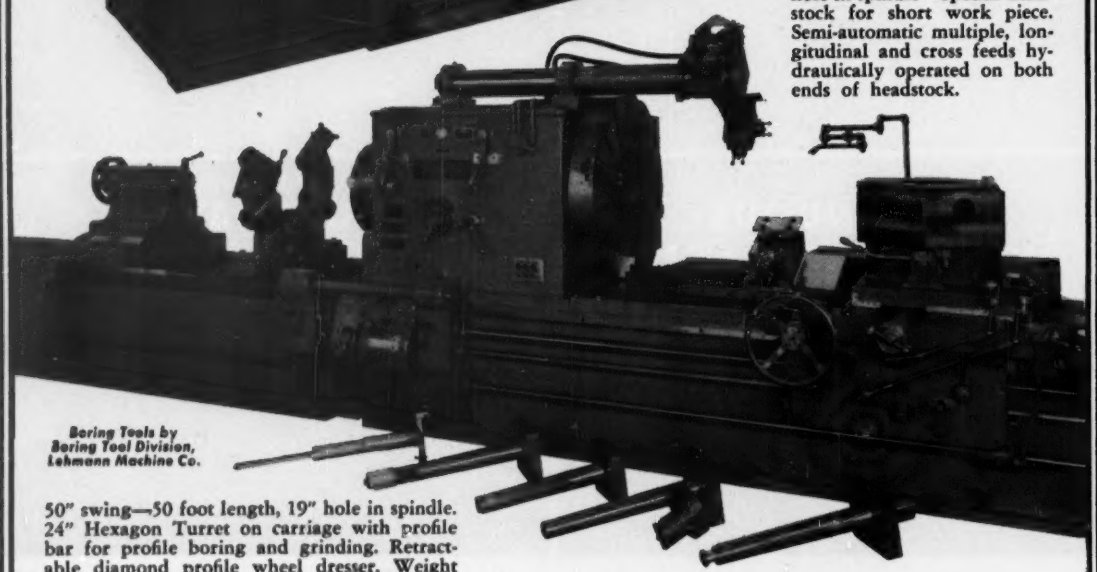
DOUBLE LARGE HOLE END!....

LEHMANN *Hydratrol* LATHES

LARGE HOLLOW SPINDLE — DOUBLE END TYPE



42" swing, 16 foot bed, 18" hole in spindle—Special headstock for short work piece. Semi-automatic multiple, longitudinal and cross feeds hydraulically operated on both ends of headstock.



Boring Tools by Boring Tool Division, Lehmann Machine Co.

50" swing—50 foot length, 19" hole in spindle. 24" Hexagon Turret on carriage with profile bar for profile boring and grinding. Retractable diamond profile wheel dresser. Weight 72,000 lbs.

Double End Hydratrol Lathes are built in sizes from 18" with holes up to 7⅛" to larger sizes with holes to suit the job. Double End operations avoid necessity for resetting the work, and insure relative concentricity of boring and turning operations and squareness of faces at both ends.

Lehmann Machine Co.

CHOUTEAU AT GRAND

ST. LOUIS 3, MO.

SCENE 41:
"Taps that Shoot!"
...an actual scene from the GTD-Greenfield sound film "FACTS ABOUT TAPS AND TAPPING"
VOICE: "This high-production tap is called a Gun tap because it shears the chips and 'shoots' them ahead of the tap . . . Designed for tapping in through holes, or blind holes having plenty of space for chip accumulation . . . Shallow flutes make Gun taps extra strong . . . Used whenever possible to minimize tap breakage."
GREENFIELD
TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS
This 26-minute full-color motion picture "FACTS ABOUT TAPS AND TAPPING" is now available for group showing through your local GTD-Greenfield distributor.

CHASERS IN OR OUT IN SECONDS

Quick chaser insertion and removal means less down time on threading jobs, and it's a big feature of GEOMETRIC "D" type Die Heads.

Just pull up a stop plunger and snap the chasers in or out of their slots in less time than it takes to tell how. No face plate to remove, no screws to replace, no parts to adjust.

Simple to operate, rugged, precision built. That's the GEOMETRIC "D", industry's BASIC DIE HEAD, the one to which all others are compared.

Write for full details. Specify Bulletin D

Greenfield Tap and Die Corporation

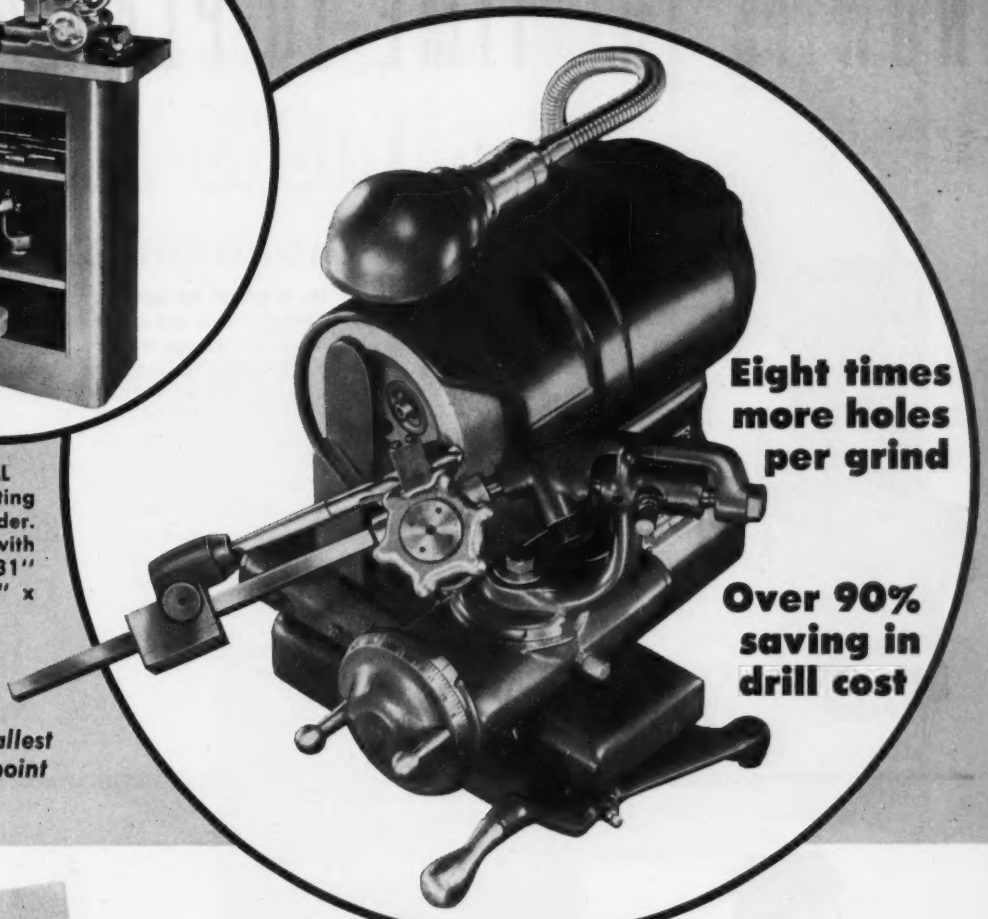
GEOMETRIC TOOL COMPANY DIVISION

NEW HAVEN 15, CONNECTICUT

GEO MET RIC

Get more than twice the usual life from your drills

CABINET-PEDESTAL
Available for mounting the No. 1-G Drill Grinder. Made from steel with wooden shelves. 31" high from floor. 13" x 30" top.



Eight times more holes per grind

Over 90% saving in drill cost

Gives even the smallest drill a production point that pays a profit

Among Heavy Machine Tools built by Consolidated are . . . .

- LATHES
- BORING MILLS
- DRILL PRESSES
- MILLING MACHINES
- BORING MACHINES
- COLD SAW MACHINES
- BORING, DRILLING AND MILLING MACHINES
- DRILL AND TOOL GRINDERS
- PLANERS
- SLOTTERS
- RAILROAD SHOP TOOLS
- AUTOMOTIVE TOOLS
- AND OTHER SPECIAL MACHINES

SELLERS NO. 1-G DRILL GRINDER

WITH BALL BEARING SLIDE

This small, self-contained, bench-type grinder embodies the sound features that have conclusively demonstrated their superiority in the larger Sellers Drill Grinders. Foremost among which are the basic principles and inherent accuracy of the Sellers Chuck and the Sellers advanced method of drill grinding. This grinder produces the Sellers point on a single drill or an exact duplication on as many drills as are required. It grinds right hand 2 lip twist drills from .028" (No. 70) up to ½" diameter to any included angle of point from 80° to 160°. Designed with ball bearing slide, ball bearing swing frame and quick-adjusting tail center which combined provide increased accuracy, reduced wear and further simplification of operation and adjustment. Sellers Drill Grinders are built to last. Part replacements are negligible, however, if required, replacement parts are always available. Complete information will be furnished upon request.

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

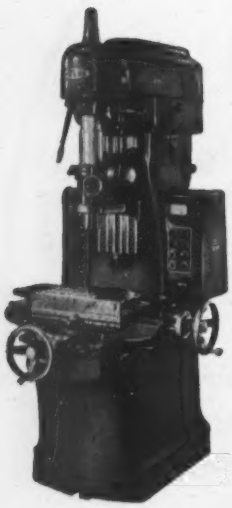
CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

SUBSIDIARY OF FARREL-BIRMINGHAM COMPANY, INCORPORATED

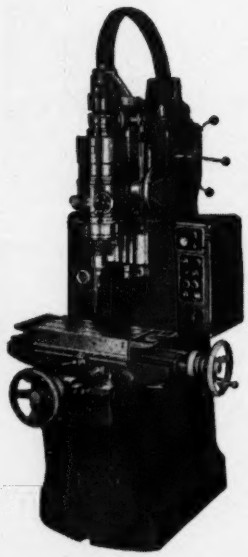
ROCHESTER, NEW YORK

NOW IS THE TIME TO PLAN AHEAD



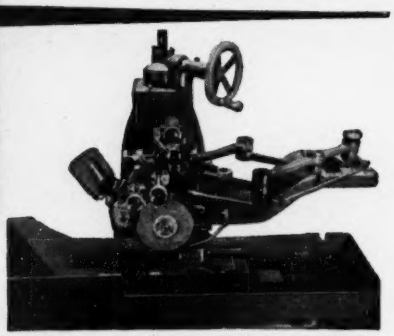
No. 2 MOORE JIG BORER, with its accurate lead screw settings within .0001", offers all the time-proven precision features associated with Moore Jig Borer construction for 15 years, plus numerous labor-saving advantages, including: increased capacity and size; infinitely variable spindle speeds; 3 power feed ratios; centralized controls.

No. 2 MOORE JIG GRINDER. With this new and larger Moore Jig Grinder, *regular and irregular contours* are ground to size and location after hardening. This extends the Jig Grinder's traditional function of relocating straight and tapered holes. Holes from 1/64" to 8" can be relocated and ground within .0001"—by power or hand feed.



Four ways to cut costs and meet competition by mechanizing your toolroom.

No. 1 MOORE JIG BORER remains in the line. For its range—table working surface of 10" by 16" and cuts up to 3½"—this machine is still an ideal buy. There are over 1000 satisfied users. We will continue to offer it for the many situations where a small, accurate jig borer fills the required prescription.



MOORE PANTO-CRUSH WHEEL DRESSER speeds form-grinding and cuts costs. Both crush-forming and diamond-dressing are accomplished with this 2-in-1 unit permanently mounted on the wheel spindle of a surface grinder. You switch from one method to the other without disturbing workpiece setting.

We'll be glad to send you complete descriptive literature on any of these machines.

MOORE SPECIAL TOOL COMPANY, INC.
734 UNION AVENUE, BRIDGEPORT 7, CONNECTICUT

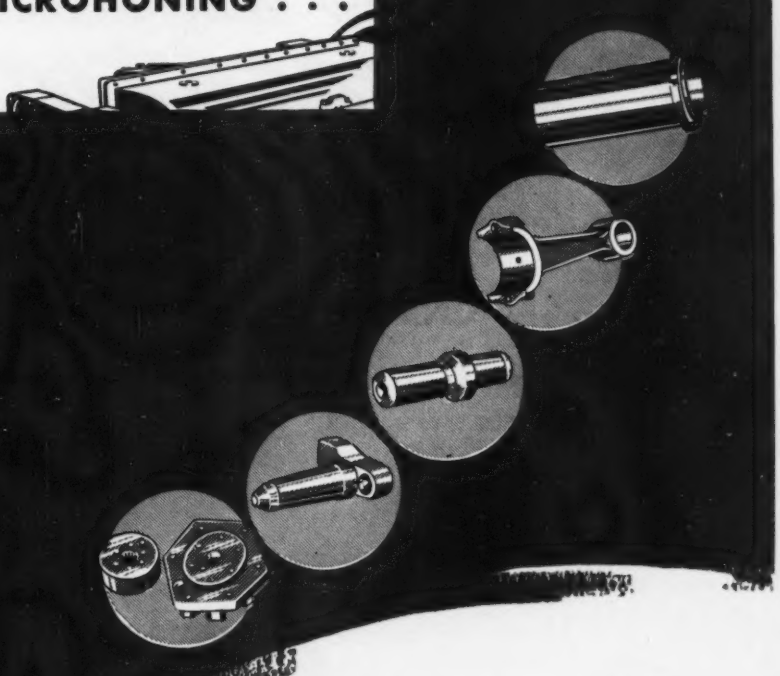
ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS · JIG GRINDERS · PANTO-CRUSH WHEEL DRESSERS · DIE FLIPPERS · MOTORIZED CENTERS · HOLE LOCATION ACCESSORIES

INCREASED EFFICIENCY OF

DIESEL ENGINES

THROUGH MICROHONING . . .



PRECISION PRODUCT ON THROUGH MICROHONING

MICRO MATIC

Diesel engines are chosen because of their dependable low cost power. The more precise the fit of parts, the more efficient the engine.

MICROHONING gives to functional surfaces of

- cylinder liners
- connecting rods
- valve guides
- injector barrels
- pump discs . . .

accurate size, true geometry, and the characterized finish—all at production rates.

For Information on MICROHONING of DIESEL ENGINE PARTS

Write for

Cross Hatch

MICROHONING = STOCK REMOVAL + GEOMETRY + SIZE CONTROL + SURFACE FINISH

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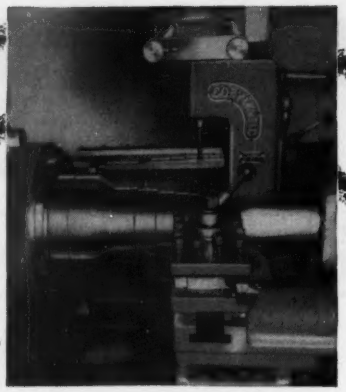
MICROMATIC HONE LTD.
55 George Street
Brantford, Ontario, Canada

MICROMATIC HONE CORP.
MICRO-MOLD MFG. DIV.
231 So. Pendleton Avenue
Pendleton, Indiana

REPRESENTATIVES: Overgard Machine Tool Company, 234 Commonwealth Bldg., Denver 2, Colorado
Hallidie Machinery Co., 2726 First Ave., South, Seattle, Wash. • REPRESENTATIVES IN ALL PRINCIPAL COUNTRIES



Canadian user reports

Lodge & Shipley COPYMATIC

. . . increases production 186%

. . . saves 65% of time

. . . combines versatility of the hollow spindle with the productivity of the Copymatic

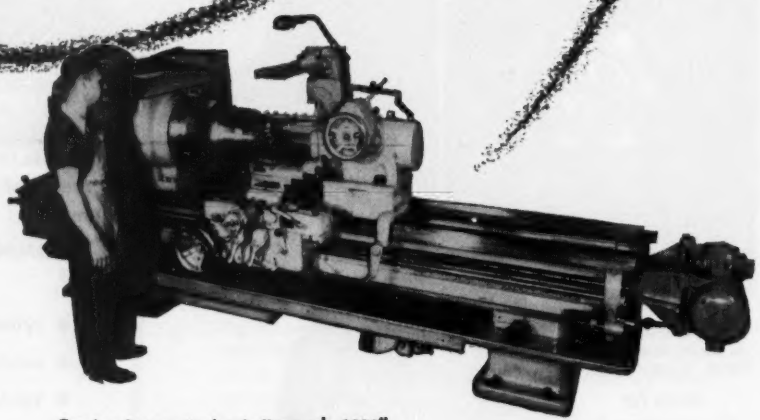
Here's still another on-the-job analysis of COPYMATIC accuracy and speed and Hollow Spindle Lathe versatility. Rough and finished turned inside and out, this heavy cast steel spindle comes down to 170 pounds finished weight with .0015" tolerance on diameters, ± .0005" on bearing diameters.

In the second operation, work is turned end for end and the small end of workpiece inserted in the Hollow Spindle.

Floor-to-floor time for complete turning and boring used to be 20 hours minimum . . . now it's only 7 hours.

Time and cost savings are reported by every one of hundreds of COPYMATIC owners surveyed. The convenience and speed of hydraulic duplication, combined with Lodge & Shipley "Model X" accuracy and versatility, make the COPYMATIC a profitable investment.

Ask your Lodge & Shipley representative to show you other case histories or write for Bulletin No. 675.



Turning heavy steel spindles to ± .0005" at Canadian Arsenals Ltd. Leaside, Ontario

THE Lodge & Shipley COMPANY

MACHINE TOOL DIVISION • 3063 COLERAIN
CHOREMASTER DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO

Into your hands — fast. Prompt delivery of the twist drills you need is one of your Union Distributor's many helpful services.

FROM GIANTS TO MIDGETS, from 3.5" diameter down to .0135", Union twist drills cut fast, cool and free, with minimum breakage and more work between resharpenings. See your Union Distributor for the types and sizes that will help boost production and cut costs on every drilling job you do — on any material, with any type of drilling equipment.

FIRST TEAM IN CUTTING TOOLS . . .

UNION and your LOCAL DISTRIBUTOR

UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS • Milling Cutters • Gear Cutters • Twist Drills • Hobs • Reamers • Carbide Tools

We own and operate S. W. CARD MANUFACTURING CO. Division, Mansfield, Mass., Taps, Dies, Screw Plates . . .
BUTTERFIELD DIVISION, Derby Line, Vt., Taps, Dies, Screw Plates, Reamers, Twist Drills . . .
BUTTERFIELD DIVISION, Rock Island, Que., Milling Cutters, Twist Drills, Hobs, Reamers, Taps, Dies, Screw Plates

Automatic Voting Machine Corporation casts its vote for **ES COMPRESSORS**

Voters in 29 different states and the Territory of Hawaii indicated their choice in the November elections by turning levers on machines made by the Automatic Voting Machine Corp. of Jamestown, N. Y. This company and its predecessors have been engaged in the development and production of automatic voting equipment since 1898.

When it came to choosing a compressor to aid in its manufacturing processes back in 1934, this leader in its field chose the leader in the compressor field . . . Ingersoll-Rand's ES compressor. Satisfaction was proven when the company chose a duplicate ES compressor in 1947 to take care of its increasing air power needs. Both machines have been operating since that time, supplying compressed air to punch and drill presses and a variety of I-R air tools.

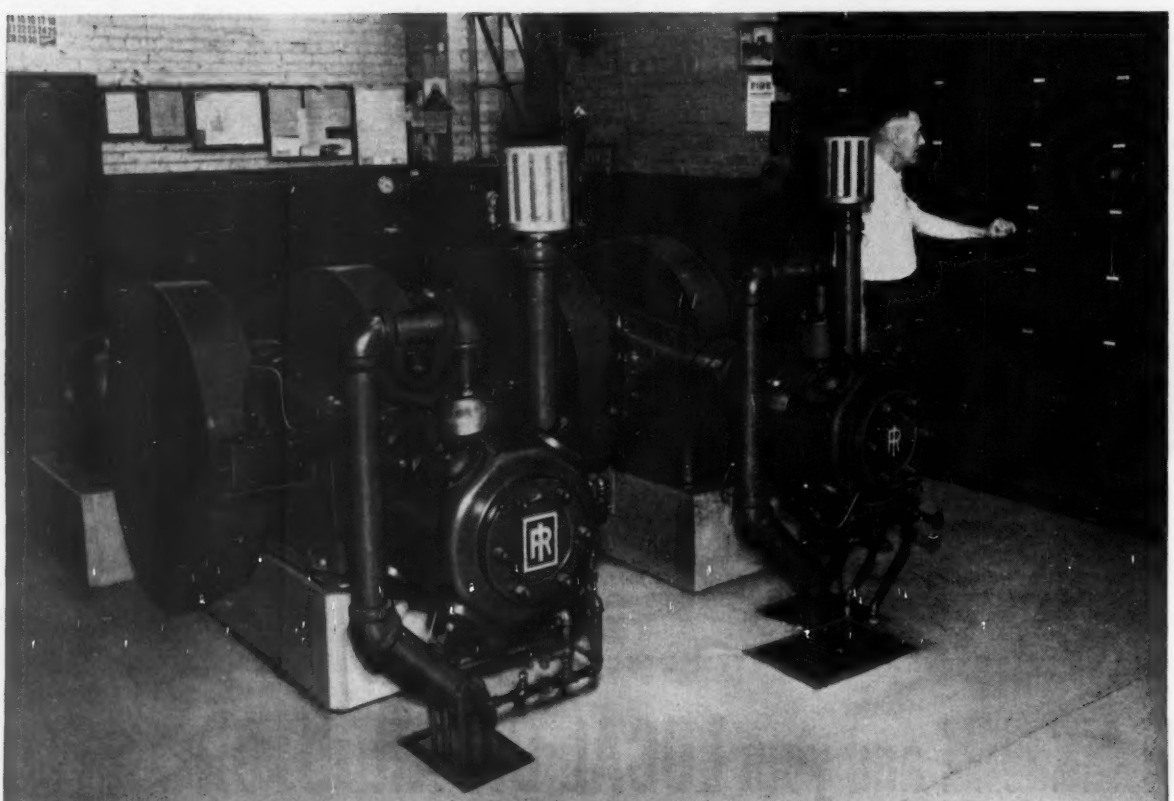
The ES compressor is designed to stand up under heavy-duty, 24 hour continuous full-load service over many years. Efficiency stays high; maintenance stays low. Sizes 5 to 125 hp with pressures from 5 to 150 psi.

The ES is of the double-acting crosshead type and is equipped with highly efficient, durable and quiet-operating Ingersoll-Rand Channel Valves.

Whatever your compressed air requirements, Ingersoll-Rand has a size and type compressor that will best serve your needs. A call to your nearest I-R branch will bring complete details.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 845-1



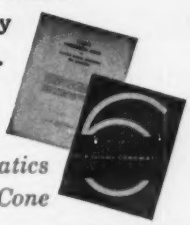
COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO-BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

Front Side of Tooling Area
Rear Side of Tooling Area

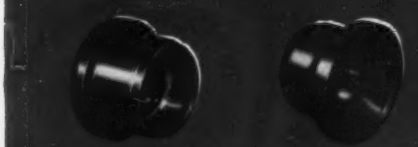
If you have a tough forming job in mind for a new "automatic," it's more satisfactory to know the recommended maximum load of the proposed machine's cross slides than to merely be told that they are *rugged.*

Before a machine can satisfy an important requirement it must be *built that way.* And built to figures instead of adjectives.

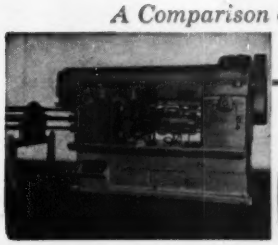
There are many factors involved in the building of any brand of Multiple Spindle Bar Automatic, factors on which you may want the figures. You may have the figures on CONOMATICS.



A Comparison of ALL Automatics is in Favor of Cone

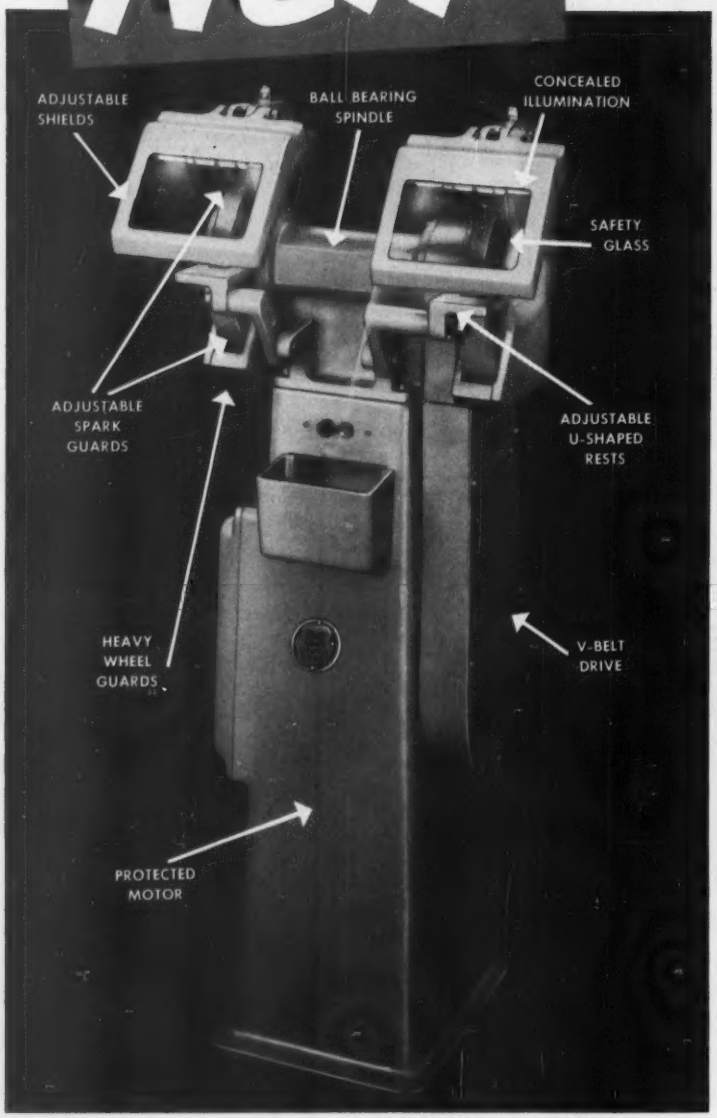


In producing the alloy steel part shown, the maximum load recommendation for each main cross slide of the 3½-SIX is 8,000 foot pounds. The total net weight of the main cross slides is 825 pounds.



Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

New SOUTH BEND Pedestal GRINDER



You will find this new grinder ideal for precision tool grinding. It is ruggedly built throughout to withstand hard service. The motor is enclosed in the pedestal and drives through a V-belt which removes the load and weight of the grinding wheels from the motor bearings, practically eliminates vibration and isolates the motor from abrasive dust.

Send coupon for complete information on this grinder that will give you long, trouble-free service.

SPECIFICATIONS

Wheel Size: 8" dia. (½ h.p. motor), 10" dia. (¾ h.p. motor).

Spindle: Approximate speed 2450 r.p.m. Sealed ball bearings.

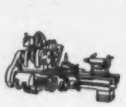
Motor: Standard 2875 r.p.m. 50 cycle or 3450 r.p.m. 60 cycle, also D.C.

Over-all Dimensions: 8" Grinder, 49½" high, 18" wide, 20½" deep. 10" Grinder, 49½" high, 18½" wide, 20½" deep.

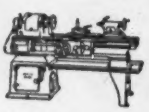
SEND INFORMATION CHECKED:

☐ SOUTH BEND GRINDER

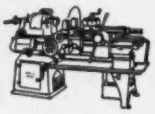
☐ TOOLS & ATTACHMENTS



☐ 9" and 10" BENCH LATHES



☐ 10" to 16-24" FLOOR LATHES



☐ ½" and 1" Collet TURRET LATHES

☐ 14" DRILL PRESSES

☐ 7" BENCH SHAPERS

Name_____ Company_____

Street_____ City & State_____

Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

tubing from strip

In one continuous, automatic operation, the AEF Tube Mill converts steel strip into the finest welded tubing. Each mill is a compact, high-speed unit that will produce the highest grade tubing with a minimum of labor, over-head, and capital investment. Over 30 years of successful performance demonstrate that the economy of operation—at ⅛ of one cent per each foot length of tubing—permits the return of the original investment in intervals ranging from 28 days to 6 months. It is impossible to purchase your pipe and tubing requirements to compete with rolling your own on an AEF Tube Mill. Our engineers will plan your installation and give your operators training in operation and procedures. Write us giving the sizes and quantities of tubing needed and the uses for which it is intended. Tubing is guaranteed to be plus or minus .003″ in diameter and concentricity. AEF Tube Mills are manufactured in three sizes, to produce pipe and tubing with wall thicknesses of .025″ to .157″ and outside diameters from ½″ to 4½″ O.D.

AMERICAN ELECTRIC FUSION CORPORATION

CHICAGO 47, ILLINOIS, U. S. A.

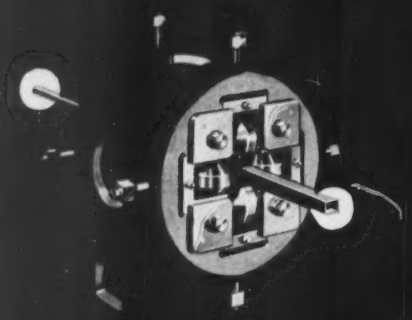
AEF

AMERICAN ELECTRIC FUSION CORP.

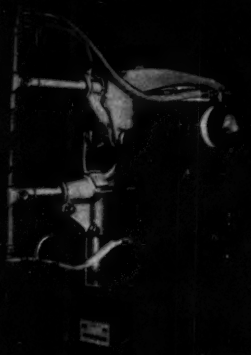
MANUFACTURERS OF ELECTRICAL WELDING EQUIPMENT

2600 DIVERSEY AVENUE — CHICAGO 47, ILLINOIS, U.S.A.

Round tubing produced by AEF Tube Mills can be formed into square, triangular, or other sections with the AEF Turkshead. Operates at Tube Mill speed. Specially formed tubing is cut by a special cutter, interchangeable with the standard AEF Cut-off Unit.



All AEF Spot Welders are designed to permit the maximum adjustment to meet specific individual requirements. They may be operated by manual foot pressure or by automatic air. Each Spot Welder is equipped with the patented "Koldpoint" Electrode Cooling System. The "Koldpoint" increases efficiency and production speed and insures a low cost of operation. It lengthens the life of the welding tips, reduces time and expense of point dressing, and produces more uniform welding. AEF Spot Welders are manufactured in three mechanical size groups and in six transformer capacities.



· QUALITY · MACHINES ·

The CBG - 24 Brazing Machine—developed originally by AEF for a leading Diesel locomotive manufacturer — is built for brazing and silver soldering coil ends of generator and motor armatures. Accommodates armatures of 18″ to 42″ in diameter and can be adapted with slight modification to any diameter requirements. The CBG-24 may also be used as a source of power supply for portable brazing equipment—and for other brazing and soldering applications.

IT'S HIS JOB TO HELP YOU SAVE TIME AND MONEY

Consistent top performance is only one of the advantages of using Card Taps. You also get a lot of practical know-how covering the range of tapping applications.

That's supplied by Card's staff of factory representatives — men whose extensive training and field experience qualify them to handle the toughest cutting tool problems.

Very likely a Card representative can come up with suggestions that will benefit your own production. He's always available for advice on any tapping operation, present or planned. S. W. CARD MANUFACTURING COMPANY, Mansfield, Massachusetts, DIVISION OF UNION TWIST DRILL CO.

ASK YOUR CARD DISTRIBUTOR FOR COMPLETE DETAILS

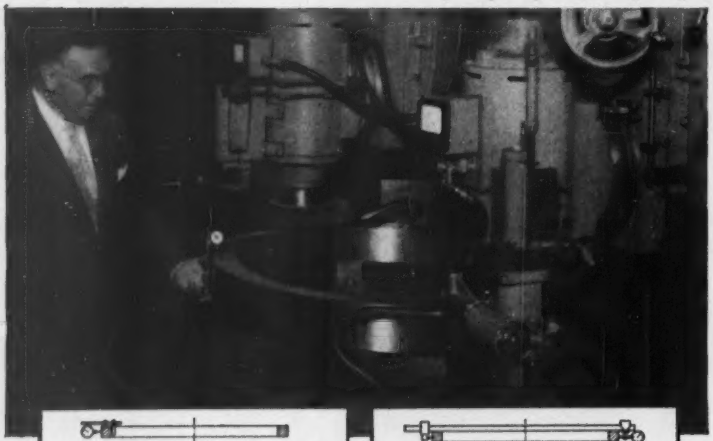
The CARD Quality

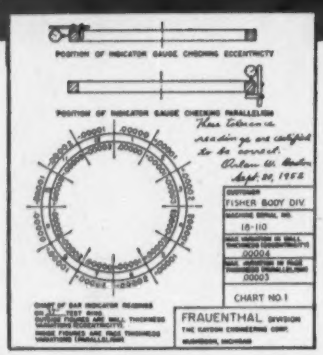
TAPS

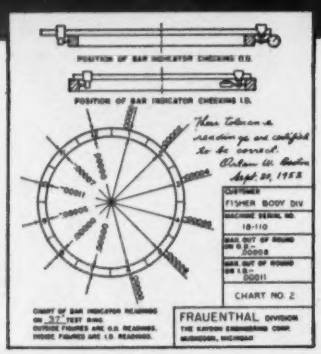
Also makers of DIES • SCREW PLATES • DIE STOCKS TAP WRENCHES

GRINDING TO millionths*

OF AN INCH







* *Our normal method of expressing tolerances in tenths-of-thousandths of an inch became inadequate when precision was attained to fractions of tenths-of-thousandths, expressed best in MILLIONTHS of an inch.*

Utmost precision proved by meticulous tests, and certified by Orlan W. Boston, Chairman, Department of Production Engineering, University of Michigan. He witnessed tests at Frauenthal plant in Muskegon and certified their validity on precision grinding of a 37-inch test ring, on Frauenthal Grinder No. 18-110 (shipped to Fisher Body Division for grinding tank bearings).

You get TOP PRECISION with Frauenthal Grinders

The certified readings listed at left are much closer than the 200-millionths of an inch precision specified for these machines. You can get similar results on other sizes of Frauenthal Multiple-Head Super-Precision Cylindrical Grinders, up to 140-inch diameter grinding on the Series 2200 machines. Uniformity of precision is assured in concentricity, parallelism and roundness. You can make many combination settings of grinding-spindle positions for a wide variety of simultaneous grindings of outside, inside and faces. Details on request.

PRECISION GAUGE READINGS • CHART NO. 1

MAX. VAR. IN FACE THICKNESS (Parallelism)				MAX. VAR. IN WALL THICKNESS (Eccentricity)			
Station	Reading	Station	Reading	Station	Reading	Station	Reading
1	.000000"	7	.000000"	1	.000000"	7	+.000020"
2	+.000010"	8	+.000020"	2	+.000010"	8	+000010"
3	+.000030"	9	+.000030"	3	+.000020"	9	.000000"
4	+.000030"	10	+.000030"	4	+.000020"	10	−.000010"
5	+.000030"	11	+.000030"	5	+.000010"	11	−.000020"
6	+.000010"	12	+.000020"	6	+000020"	12	−.000010"

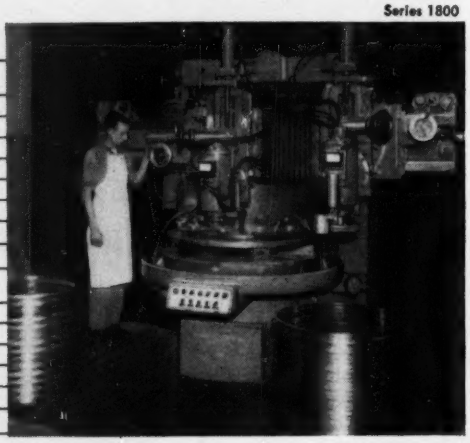
Maximum Variation in Parallelism: .000030" Maximum Variation in Eccentricity: .000040"

PRECISION GAUGE READINGS • CHART NO. 2

MAX. OUT-OF-ROUND ON O. D.				MAX. OUT-OF-ROUND ON I. D.			
Station	Reading	Station	Reading	Station	Reading	Station	Reading
1	.000000"	4	−.000050"	7	.000000"	10	−.000110"
2	−.000020"	5	−.000080"	8	.000000"	11	−.000070"
3	−.000040"	6	.000000"	9	−.000050"	12	.000000"

Maximum Variation, Outside Diam: .000080" Maximum Variation, Inside Diam: .000110"

Series 1800



What is YOUR Grinding Problem?

Through more than a decade of toolroom and production grinding, Frauenthal Grinders have been performance-proved on tough precision jobs, such as helicopters, jet engines, army and navy tanks and gunmounts, Diesel engines, machine tools, 120-inch diameter KAYDON precision bearings and similar products. We'll be glad to work with you on difficult grinding problems.

made in 10 standard sizes . . . conforming to essential J.I.C. specifications

	Series 1800	Series 2000	Series 2200
Table sizes	30" 36" 42" 48"	60" 72"	110" 120" 130" 140"
Maximum Swing	56" 56" 56" 56"	72" 88"	120" 130" 140" 150"

Ask for Bulletin

Frauenthal Division THE KAYDON ENGINEERING CORP., MUSKEGON, MICH.

PRECISION-GRIND INSIDE, OUTSIDE AND FACES SIMULTANEOUSLY

This Tiny Tap Tells a Big Turning Story

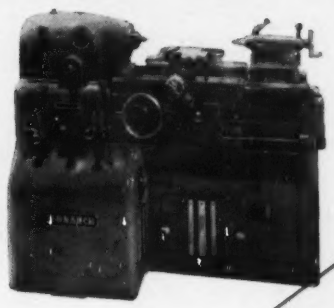
This tiny part portrays better than words the extreme accuracy you can expect from a Monarch 10" Model EE Precision Toolmaker's Lathe. The operation detailed below was actually performed on a standard lathe which is employed primarily to turn a variety of parts for small, precision, automatic tapping and drilling machines for the user's own manufacturing operations. These master taps which he chases occasionally are needed to make a master die. This, in turn, is used to produce working taps in quantity. End use is tapping a hole in the end of surgical needles to permit holding of the suture.

How surgeons thread the needles, we'll never know. We do know that in all probability you'll never have to work as fine as 200 threads per inch. But accuracy like this can be just as important to you, regardless. With the Monarch 10" Model EE, as a look at the listed features will at once reveal, you get a machine unequaled for precision, speed and sensitivity. Like most of the Monarch line of lathes, it can be furnished with "Air-Gage Tracer" controls . . . *The Monarch Machine Tool Company, Sidney, Ohio.*

Surgical needle master tap—overall length, ¾"—diameter, .0218"—threads per inch, 200—thread accuracy, lead within .0001 over the entire threaded length of ⅛".

MONARCH 10"
MODEL EE FEATURES

- All electric drive direct to spindle through multiple "V" belts. No gears in headstock.
- A true high speed lathe for small work. Available with speed range up to 40 to 4000 R.P.M.
- Totally enclosed, automatically lubricated end gearing and gear box.
- Flame hardened and ground ways for both carriage and tailstock. Bed all in one piece—no inserts.
- American standard Camlock spindle nose—for quick, rigid and accurate chuck and fixture mounting.
- Easy, fatigue-free operation. Base design permits operator to work close comfortably. He gets production—not backaches.
- Over 6000 10" Model EE machines in use.
- The only small lathe available with antifriction bearing taper attachment.
- For thread chasing up to 100% faster, has exclusive combination of electric lead-screw reverse and variable reverse speed control.



Monarch
ACCURACY • ECONOMY • LONG LIFE
TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH

THE MONARCH MACHINE TOOL CO., Sidney, Ohio

Gentlemen:
Please send me without obligation your complete illustrated Booklet #302, covering the 10" Model EE Monarch Sensitive Precision Toolmaker's Lathe.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

GREAVES MACHINE TOOL CO.

Cuts Boring Time on Columns

75% with BUNELL TOOLING

● **The Greaves Machine Tool Company of Cincinnati, Ohio, a leading manufacturer of Milling Machines, has reduced the time required for boring their machine columns by 75% with Bunell Tooling.**

● **Greaves is also consistently obtaining a greater degree of precision and accuracy by the use of Bunell Boring Fixtures and Boring Bars (illustrated above). Time and labor savings like this speed production and help Greaves reduce costs and meet shorter delivery requirements of customers.**

● **Bunell's complete modern plant facilities and experienced engineering staff are available to help you with your tooling problems. Write for full information.**

WRITE FOR FREE CATALOG which describes Bunell services, facilities and equipment.

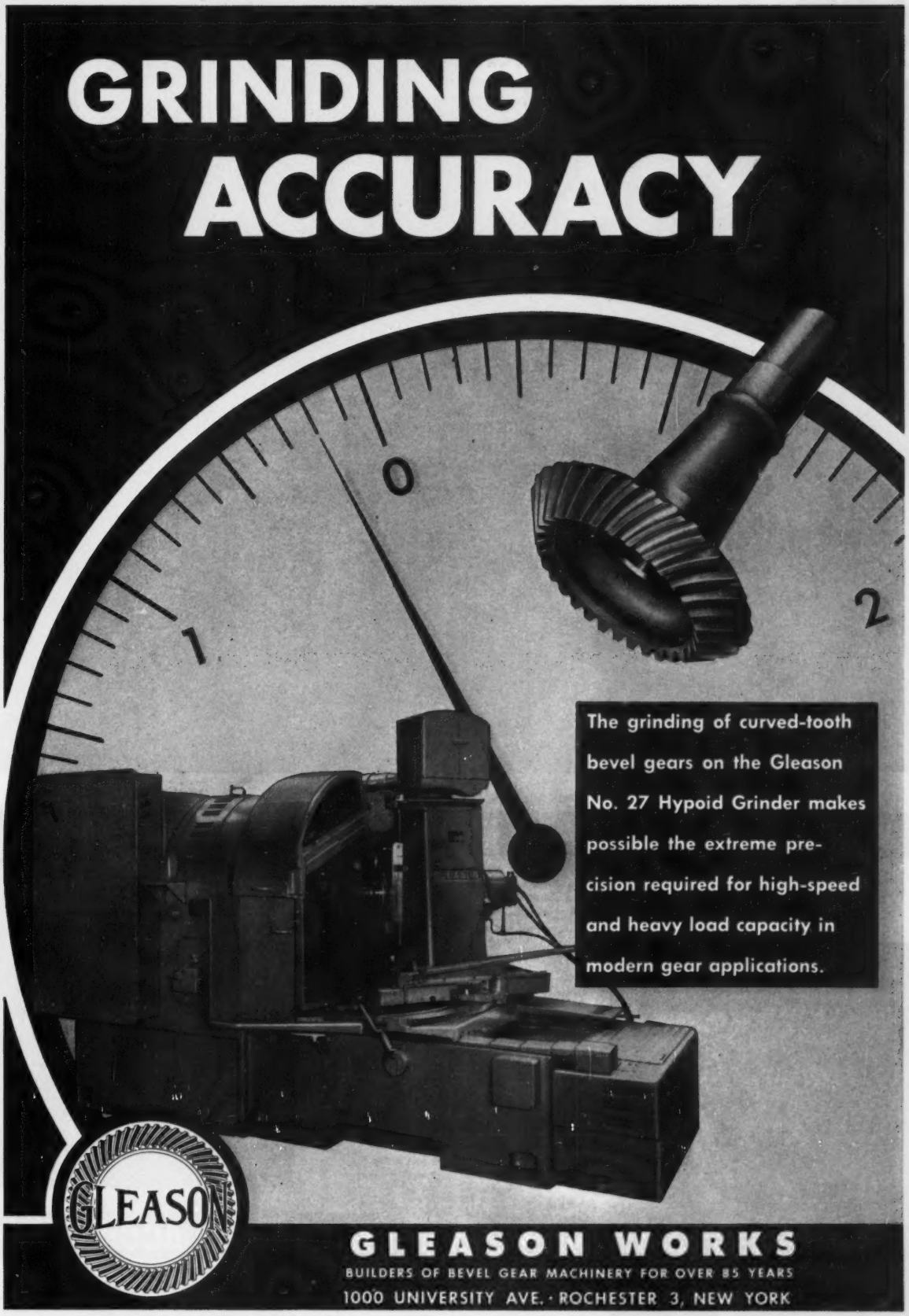
THE BUNELL MACHINE & TOOL CO. CLEVELAND, O. BUNELL

BUNELL MACHINE AND TOOL CO.

1600 EAST 24th STREET • CLEVELAND 14, OHIO

Since 1920. Designers and Builders of Special Tools, Dies, Jigs, Fixtures and Special Machines

GRINDING ACCURACY



The grinding of curved-tooth bevel gears on the Gleason No. 27 Hypoid Grinder makes possible the extreme precision required for high-speed and heavy load capacity in modern gear applications.

GLEASON

GLEASON WORKS

BUILDERS OF BEVEL GEAR MACHINERY FOR OVER 85 YEARS

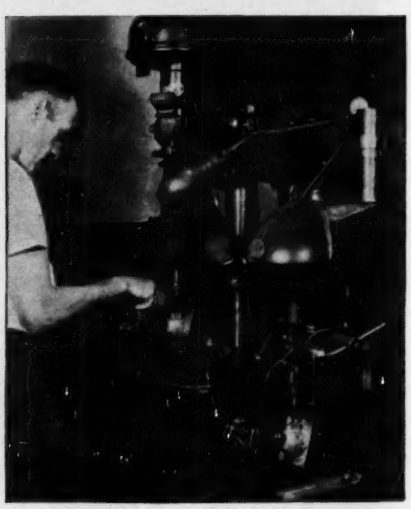
1000 UNIVERSITY AVE. · ROCHESTER 3, NEW YORK

DELTA MILWAUKEE

DELTA QUALITY MAKES THE DIFFERENCE

DELTA Means VERSATILITY—

In one line at the Astatic Corp., 18 Delta drill presses work interchangeably on such materials as steel, zinc, plastic thermo and bakelite, aluminum and brass. Overhead lines carry power and air and are set up so that additional machines may be moved in and out of the line as job conditions change.

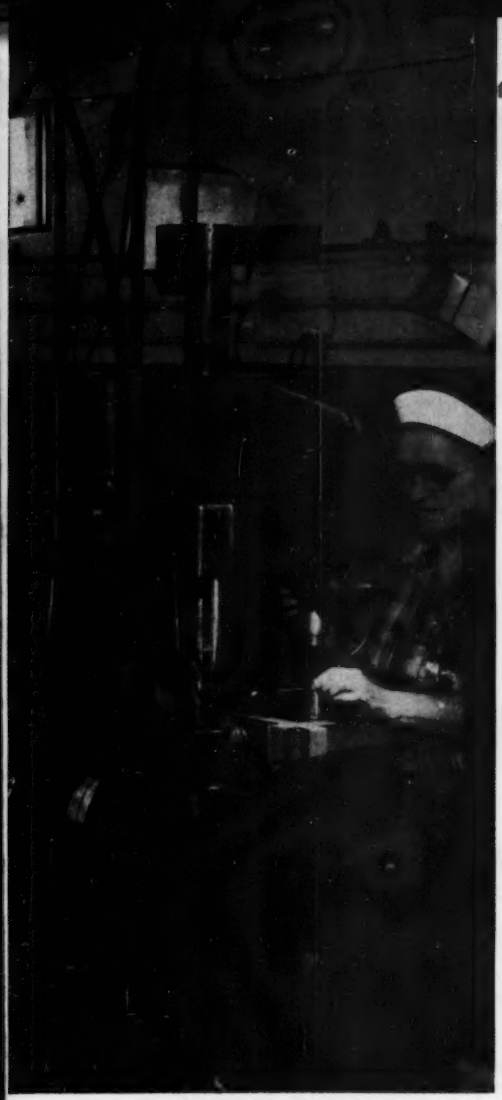


DELTA Means MOBILITY—

Says Astatic: "An example of how we move our Delta tools to the job is the case of putting two 17 inch drill presses side by side so that a piece can be countersunk on one, tapped on the other by the same operator. In many cases we move Delta tools to the material instead of the material to the machine."

DELTA Means ACCURACY—

"With simple fixtures and Delta accuracy we make jobs practically fool-proof on machines which almost run themselves," reports the Astatic Corp. Astatic products for the communication industry are manufactured to high precision standards.



Down Go Costs WHEN ASTATIC CORP. PUTS DELTA TOOLS ON JOB

These Production Ideas Will Work For You, Too.

Here's how the Astatic Corp., Conneaut, O., gets high production and high precision at low cost with a shop full of Delta tools—drill presses, grinders, bandsaws, table saws, jointers and belt sanders. This story of a manufacturer of microphones, radio, phonograph and television parts can apply equally well to your plant.

FLEXIBILITY — Because Delta tools are light and mobile, Astatic takes them to the material to be machined, cutting handling costs. They are moved in and out of the production line as jobs change, already set up to eliminate down time. As many as five different materials from steel to plastics are machined on the same Delta tools.

INTERCHANGEABILITY — By standardizing on Delta, Astatic uses the same jigs and fixtures on several machines without adjusters.

FEWER SET-UPS — By keeping machines set up for special jobs one operator can tend several machines and do sequence operations on a single part before laying it down. No waste motion. Because Delta tools are a low capital investment, they don't have to run constantly to pay out.

QUALITY — Most of the Delta tools at Astatic have been on the job six to nine years with only routine maintenance. The Astatic record proves that Delta gives you machine tool quality at a cost any production operation in your plant will justify.

Do you have an up-to-date catalog of Delta tools? Call your Delta dealer. He's listed under "Tools" in your Classified Phone Book. Or write direct to Delta Power Tool Division, Rockwell Manufacturing Company, 614A N. Lexington Avenue, Pittsburgh 8, Pa. Ask for Catalog AB52.

DELTA Means LOW COST—

Here's the Astatic story: "Because the cost of Delta tools is low, it is advantageous to maintain set-ups even if they are used only intermittently. Often an operator performs an operation on one machine, then turns to another for the second operation, saving the cost of repeated set-ups."

DELTA QUALITY POWER TOOLS

Another Product by **Rockwell**

IT'S RESULTS THAT COUNT!

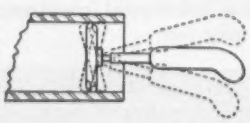
STANDARD

DuBo* Plug Gages

Produce Superior Results

COLOR FLASH HANDLES
"GO" — GREEN
'NO GO" — Red

THE VALUE of a gage is "what it tells", "how well" and "how easily". If the job at hand calls for fixed limit gages, DuBo Plug Gages will give you the best value in dimensional control. DuBo tells MORE, MORE EASILY.



Operates by Tilting Handle

Whether handle will drop freely or not is the definite yes-or-no indication. No guesswork, no forcing, no fumbling!

MORE DEFINITE CHECK There is no uncertainty with DuBo as with the cylindrical type gage, whether the hole is smaller than the plug, or larger and merely close. DuBo not only checks dimensional accuracy but also reveals taper and out-of-roundness. DuBo reduces the number of parts needlessly rejected or improperly passed.

EASIER OPERATION The DuBo Plug Gage weighs from 70 to 80% less than cylindrical plug gages of the same dimension. It is self-piloting, no trouble at all to enter. A "feather touch" is all that is needed for operation. See diagram at left.

Double end DuBo Plug Gages Under 1.510"

Single end DuBo Plug Gages Over 1.510"

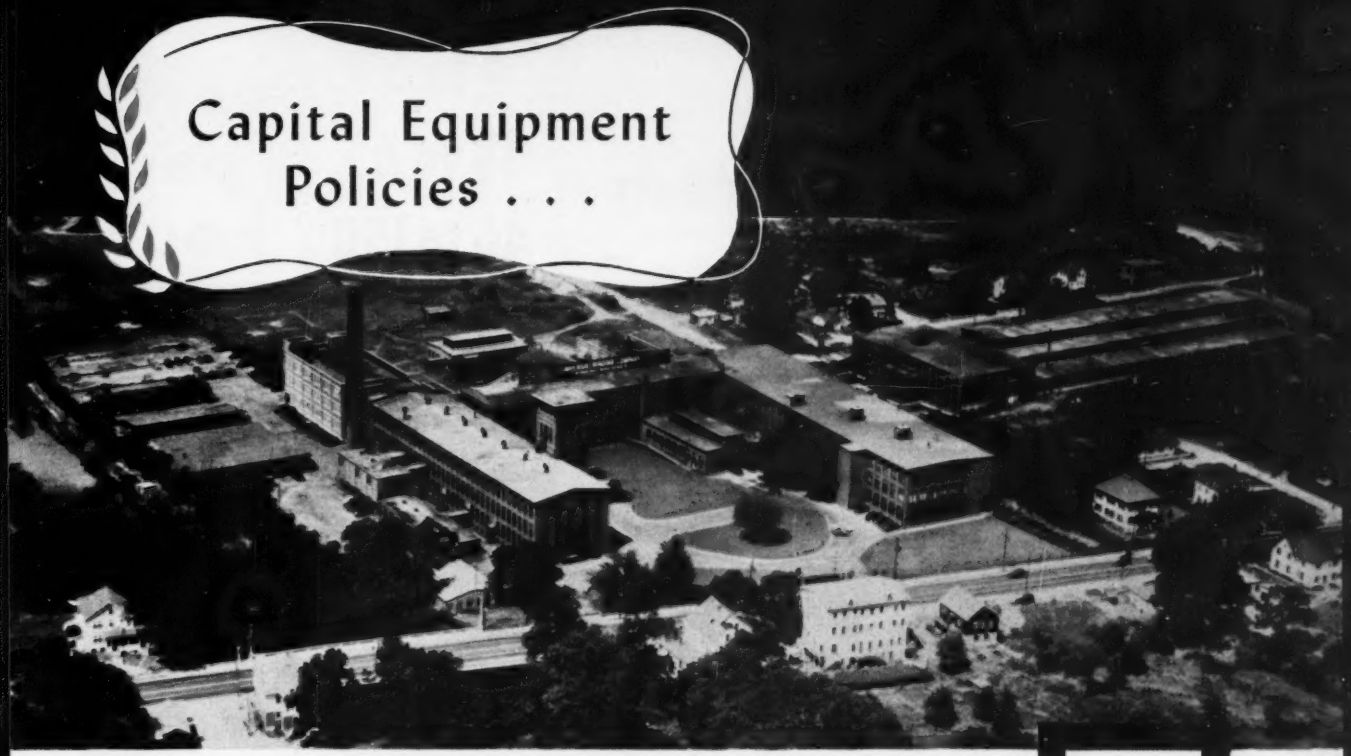
LONGER LIFE Gaging surfaces of the DuBo contact the bore walls only at the instant of making the check. DuBo gives you effective, economical gaging.

Write for Complete Information

* U.S. and Foreign Patents Granted

STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

Capital Equipment Policies . . .



Aerial Photograph of Universal Winding Company, Providence, R. I.

at the Universal Winding Company

"The Universal Winding Company deals with capital equipment from two standpoints in that it manufacturers capital equipment for the textile and electrical industries with capital equipment bought largely from the machine tool and allied industries. The same policies which govern our development of machinery for our customers govern the purchase of capital equipment for our own plant; namely, that the new equipment must show an economic saving over the equipment currently in use. Our development program for our own products and our purchasing policy are indentical in this regard.

"The analytical work necessary to determine the economic advantages of capital equipment was complex and highly controversial up to the time that the Machinery & Allied Products Institute published "A Dynamic Equipment Policy" in 1949. This outstanding work by Dr. George Terborgh has laid most of the ghosts which plagued the analysts in the past. The important factors to be considered have been given proper weight and the analytical procedures give our engineers an extremely useful and ready tool for making recommendations to the Company on both sales and purchasing policies.

"When a MAPI analysis shows that a machine tool or other piece of manufacturing equipment is costing us money by its presence in the plant, we consider it just as significant a leak of our funds as any other unnecessary expense which we may be incurring, and the proper replacement equipment is ordered."

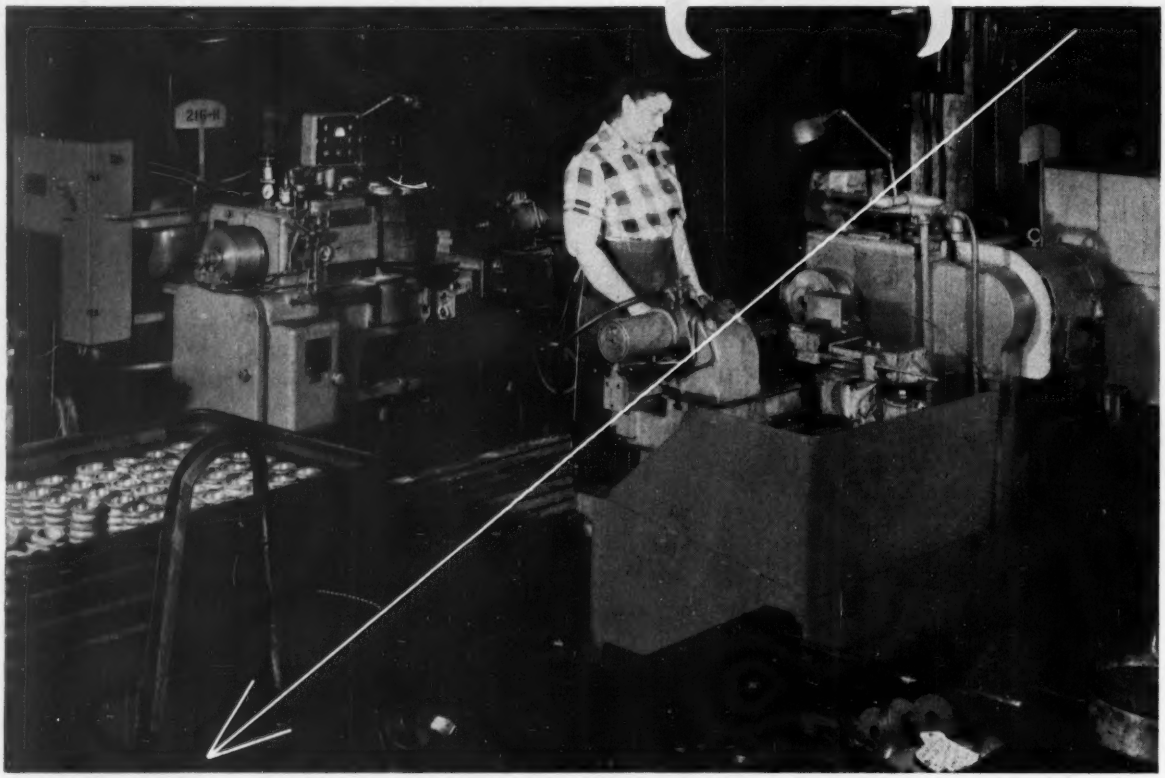
ROBERT LEESON, *President*
UNIVERSAL WINDING COMPANY

ROCKFORD
INSERT
GROUP

Keep Gathering Metal-Working Production Ideas...Be Well Informed When The Time For Replacement Arrives . . . . . .

January, 1953

Production Increased from { 4 to 32 / 18 to 65 / 40 to 150 } parts per hour



on SUNDSTRAND Automatic Lathes

These are only three of the production figures from 17 different parts turned on two Sundstrand Automatic Lathes, part of a modern turning installation. Lot sizes vary from 150 to 200 pieces. Parts are of cast iron and steel and are used in production of heavy machinery. All jobs have a better than 2 to 1 production increase over former method.

One Operator Handles 2 Machines

The units in this battery of Automatic Lathes are installed with facing fronts, as shown in the above illustration. Because of the simplicity of operation, one operator can easily run two machines. If you have turning problems in your plant call in a Sundstrand Methods Engineer. There is no obligation for this service.

SUNDSTRAND

RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT

MADE IN
ROCKFORD... TESTED ENGINEERING AND CRAFTSMANSHIP
ILLINOIS, U.S.A.

Machinery, January, 1953

Design Features of Sundstrand Automatic Lathes that make this production possible . . .

Greater Horsepower All new Sundstrand Automatic Lathes have been redesigned for greater rigidity and larger spindle drive motors. They have ample power for use of carbide cutting tools and are capable of doing more work.

Wider Speed Range Spindle speed range ratios have been increased to 30 to 1 to obtain maximum in cutting efficiency over a wider range of sizes of parts and material. The spindle unit is equipped with two driving gear centers, which increase the range between high and low spindle speeds. In addition, four speed changes can be obtained from one set of gears instead of the usual two.

Wider Feed Range A wider feed range has been provided to enable the handling of a greater range of parts and materials at maximum cutting efficiency. The New Models 4A, 8A, and 12A have a ratio of 18 to 1 between high and low feeds — Model 16 has an even greater range.

Greater Carriage Adjustment Both front and rear carriage of the latest Sundstrand Automatic Lathes are adjustable full length between headstock and tailstock centers — another important new feature.

Faster Set-Up Convenient location of pick-off gears for changing spindle speeds and front and rear carriage feeds is provided. Feed and speed chart and pick-off gear storage compartments are readily accessible for quick set-up or changeover.

Quick Cycle Changeover Complete control of all cycles is provided by adjustment of dogs on a disk. Making cams is eliminated. Changing position of dogs on disk changes length of rapid approach, feed and rapid return strokes — enables operator to set up cycle quickly and change over from one job to another easily.

Automatic De-Clutching All new models have been provided with automatic declutching between spindle and spindle motor with self-adjusting magnetic clutch and brake for quick stopping of spindle rotation.

Screw Feed to Front Carriage All new Sundstrand Automatic Lathes have screw instead of rack feed to the front carriage — resulting in fine finish and long tool life.

4 Models Cover HP Range of 3 to 75 HP

	MODEL 4A	MODEL 8A	MODEL 12A	MODEL 16
SPINDLE MOTOR	3 to 10 HP	10 to 25 HP	20 to 50 HP	50 to 75 HP
SPEED RANGE (Type A) (Type B)	60 to 1800 RPM 120 to 3600 RPM	40 to 1200 RPM 80 to 2400 RPM	30 to 900 RPM 60 to 1800 RPM	15 to 750 RPM
FEED RANGE	.003 to .048 IPR.	.004 to .070 IPR	.004 to .070 IPR	.0025 to .100 IPR
FRONT CARRIAGE: Longitudinal feed with angular feed-in, max. Swing over cross slide, max. Rapid traverse rate	 5″ 8¾″ 275″	 6″ 12½″ 250″	 8″ 15¼″ 250″	 12″ 17″ 250″
REAR SLIDE: Max. Stroke	4″	5½″	6½″	8″
LENGTH BETWEEN CENTERS	15, 24 & 36″	24, 36, 48 & 60″	24, 36, 48 & 60″	36, 60 & 84″

FREE Additional Data...

The complete new line of Sundstrand Automatic Lathes includes the Models 4A, 8A, 12A and 16 ranging from 3 to 75 HP. Write for complete information on these new machines today. Ask for Bulletin 627.

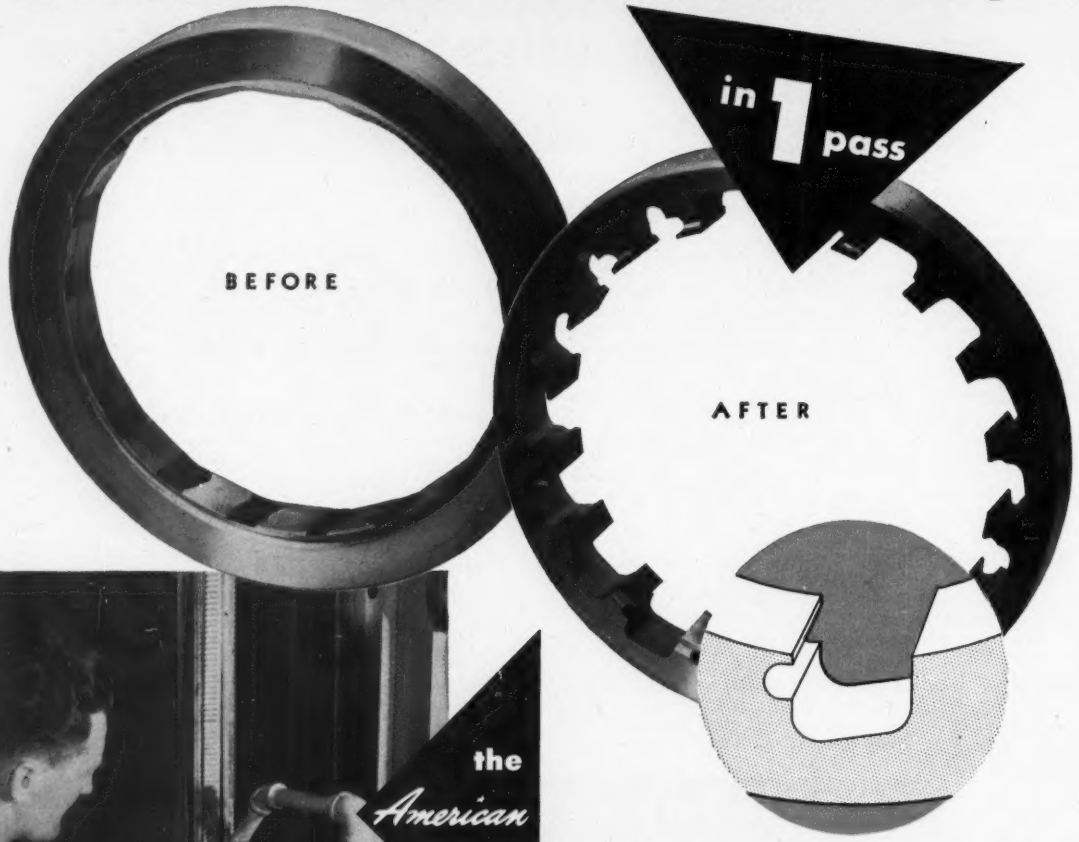
SUNDSTRAND

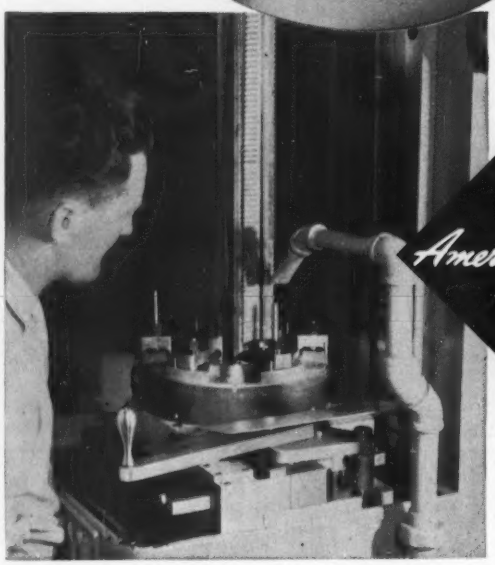
SUNDSTRAND
Machine Tool Company
2530 Eleventh St. Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

MADE IN
FOR PRODUCTION MACHINE TOOLS IT'S...ROCKFORD
ILLINOIS, U.S.A.

This intricate form broached accurately...





This is only one example of how American designs broaches, machines, and fixtures to save time, labor and machine operation costs. You can get these advantages too, by sending a part-print or sample and hourly requirements to the organization that builds all three . . . broaches, machines and fixtures. Write Dept. M today! No obligation.

An American Vertical Hydraulic 72" stroke machine was equipped with special tooling to broach the 18 slots and adjacent undercuts in a stator ring in 18 passes — these slots being held accurately with respect to form as well as location.

The machine has a hardened and ground broach holder carrying two broach sections which are guided through the fixture base in hardened and ground guides. The manually operated index fixture mounted on a cross slide moves the part in and out of broaching position. This provides clearance for the broach and holder assembly and permits unloading and reloading of the part as well as indexing of the fixture.

The broach inserts mounted side by side rough broach two slots simultaneously and finish respectively a cam surface in one slot and adjacent undercut in the other. 18 slots are broached in 18 passes to complete the operation, the slots being broached to a depth of approximately .500.

Write for circular No. 300

AMERICAN **American BROACH & MACHINE CO.**

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

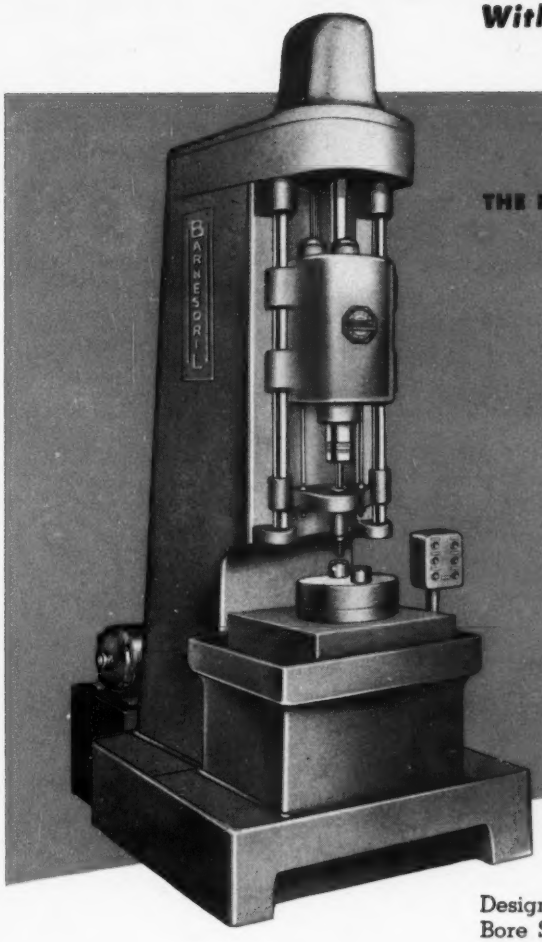
MADE IN **ROCKFORD**...FOR ACCURATE, FAST METAL REMOVAL

ILLINOIS, U.S.A.

Machinery, January, 1953

COMPLETELY AUTOMATIC BORE-TO-BORE SIZING

With Electrically Controlled Hone Feeds



THE NEW NO. 223 BARNESDRIL HONING MACHINE

Offers These New Design Features:

Automatic Fixturing
Rotary and Lateral Indexing
Hydraulic Stroke Thrust on Centerline of Work

For High Production Finishing of Small Bores

On Connecting Rods
Small Combustion Engines
Refrigerator Parts
Gears Bearings
Aircraft-Jet Engine Parts
Automotive, Farm Equipment and Diesel Engine Parts

Designed especially for completely Automatic control of Bore Sizing, this latest BARNESDRIL development completely removes the sizing operation from the effects of eccentric or uneven stone wear, and dependency on the honing tools. Sizing is now determined entirely by the hole. It permits automatic sizing of counterbored and blind holes with equal ease.

A completely new machine in a new line of advanced high-production Honing Equipment, the No. 223 has a range of 5/8″ to 3″ bore, with 12″ stroke. Maximum length of bore finishing is 10″.

Its objective is reduced work handling and non-productive time. It provides truly high-production finishing with a minimum of production controls. It is a machine that you will want to fully investigate for fast, high quality, low cost finishing.

Write for a Proposal On Your Small Diameter Work

BARNES DRILL CO.

BARNESDRIL

820 CHESTNUT STREET • ROCKFORD, ILLINOIS

MADE IN
YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN...ROCKFORD
ILLINOIS, U.S.A.

FASTER CHECKING . . . STRAIGHTENING, BALANCING, SCRAPING

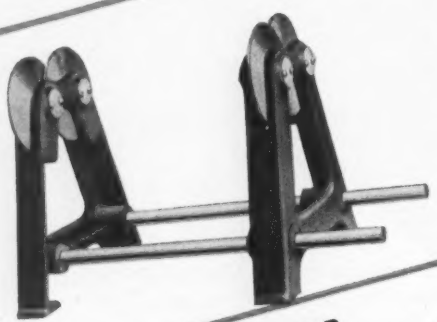
HYDRAULIC POWER PRESS

Built with Stationary or Traveling Ram . . . capacities up to 10, 25, and 50 tons . . . so sensitive and accurate that a shaft may be bent .001". Pressure gauge, indicating ram loading . . . adjustable dial indicator shows amount of shaft run-out in pre-loaded, fully loaded, and unloaded positions.

Flexible, sensitive control by rotary control valve operated by hand lever. An infinite range of loading up to capacity as lever is moved from 0 to maximum displacement. Push button control of hydraulic unit. Work table, 60" or 108" long. Available attachments include checking rolls, spring loaded centers, adjustable anvils and indicator. To increase production speed, an adjustable stop collar limits the stroke of the ram.

BALANCING WAYS

For balancing, straightening and truing operations. No leveling or centering required. Simply place part to be tested on the four chilled iron discs rotating on supersensitive ball bearings. Made in five sizes . . . 20" to 96" swing.



POWER SCRAPER

Has a "natural hand control" . . . as easy to use as a hand scraper. Left hand serves as guide to the blade . . . right hand controls the stroke. Pressure of left hand controls depth of cut, but forward cut requires no back-breaking labor. A slight forward pressure on cylinder with right hand starts swift, smooth forward stroke which can be regulated from nothing to 3½ feet . . . 60 feet per minute, reverse speed 90 feet per minute. Operator can work at a steady rate without tiring as ¼ h.p. motor does heavy cutting. With this machine one man can do the work of several. The Anderson Power Scraper, mounted on an elevating truck, is easily moved to any location. Machine may be plugged into electric lamp socket and be ready for use. In scraper housing directly across from motor is a scraper blade grinder . . . a convenient, speedy means of resharpening scraper blades without leaving machine.

Send for Bulletin 11-6

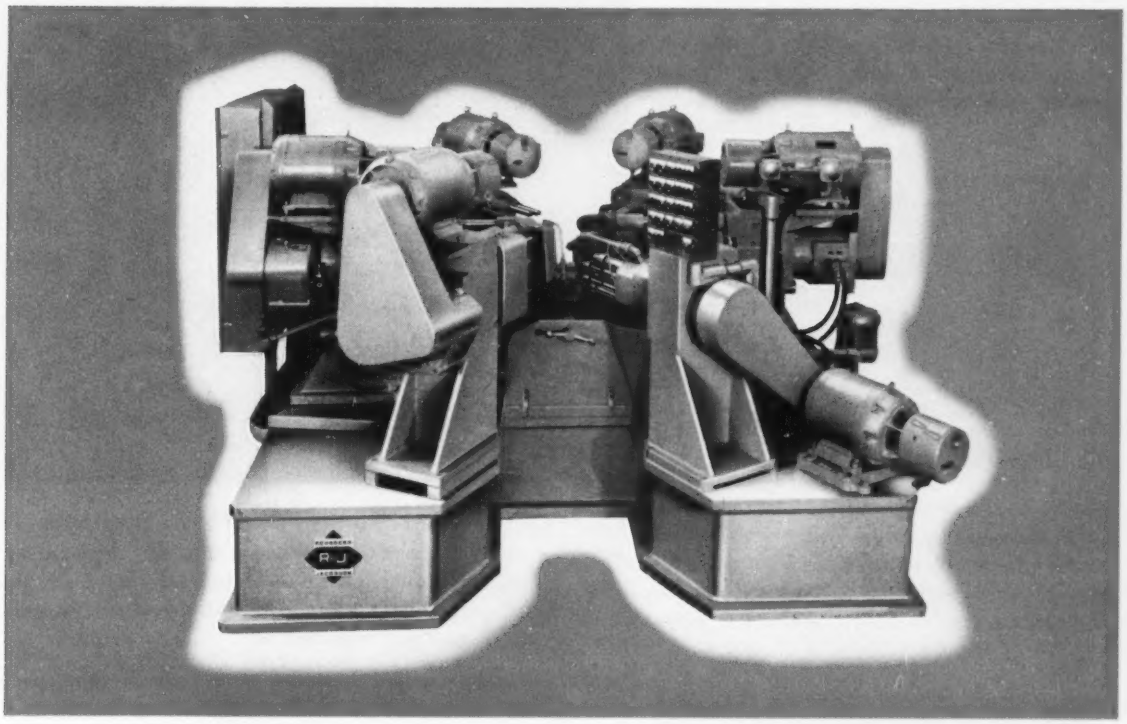
ROCKFORD Anderson BROS. MFG. CO. ILLINOIS

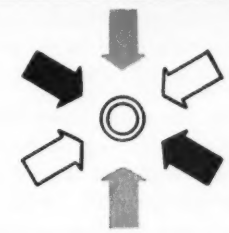
ANDERSON BROS. MFG. CO., ROCKFORD, ILLINOIS

MADE IN
ROCKFORD...MACHINE TOOL SHOPPING CENTER
ILLINOIS, U.S.A.

Rehnberg-Jacobson

A "DIFFERENT" MACHINE FOR DRILLING, COUNTERBORING, AND TAPPING CYLINDER HEADS





THESE UNITS WORK IN POSITION #1

THESE UNITS WORK IN POSITION #2

THESE UNITS WORK IN POSITION #3

WORK INDEXES AUTOMATICALLY TO THREE POSITIONS...

Here is another way of combining standardized R-J Drill, Tap, and Index Units to produce an efficient production machine tool. This machine is, in effect, three double-end machines in one, with the work indexed successively to the three sets of units as indicated by the diagram at the left. The operator simply clamps the work in its fixture on the index table and depresses a single button. The machine then performs a total of 45 operations in the three positions and stops automatically. It is another example of how the ingenuity of Rehnberg-Jacobson engineers helps to solve production problems.

REHNBERG-JACOBSON MFG. COMPANY

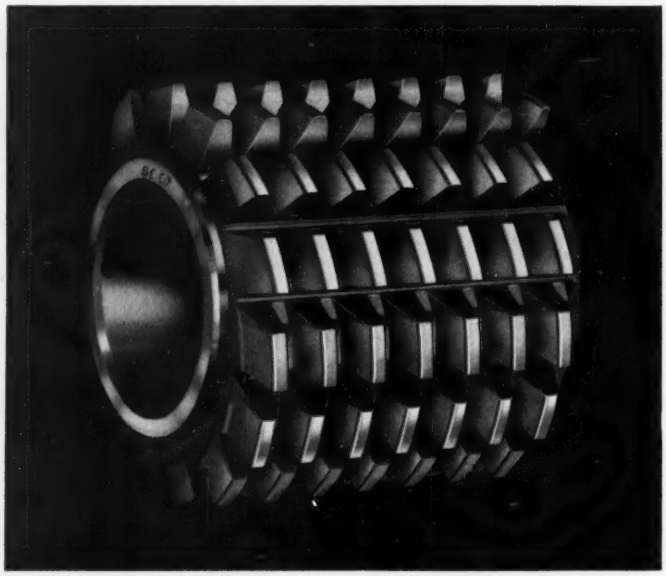
DESIGNERS & BUILDERS OF SPECIAL MACHINERY

2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS

ROCKFORD MADE MEANS PRECISION MADE...

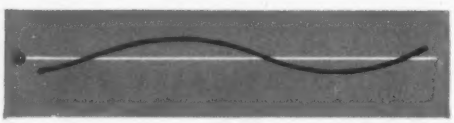
MADE IN ROCKFORD ILLINOIS, U.S.A.

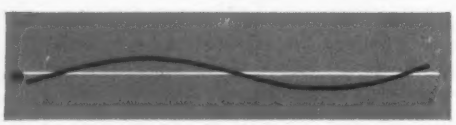
CLASS AA HOBS
FOR THE FINEST IN GEAR ACCURACY



CONTROL LIMITS WITHIN CLOSE RANGE

Although the hob is not the only factor affecting the accuracy of gears, it does have an important effect, particularly upon the profile of the gear. Barber-Colman makes hobs to all the standard tolerances to satisfy any of your gear requirements.





In addition to the standard classes, Barber-Colman has developed the Class AA hob which is made to consistently closer tolerances than any other hobs. This class of hob has proved itself in actual production for many years and is recommended for the utmost in accuracy if other conditions warrant the use of such a fine tool.

Within established standard hob tolerances, some hobs naturally approach high or low limits to a greater degree than others. On certain classes of work, it may be necessary to select from your tool crib the hobs which cut the most accurate gears. In such cases when you require hobs of the finest and most consistent accuracy, we suggest your consideration of Class AA hobs.

In many cases, your gear requirements may not demand this degree of precision control. But whatever your hobbing problems may be, Barber-Colman Engineers will be glad to help you solve them.

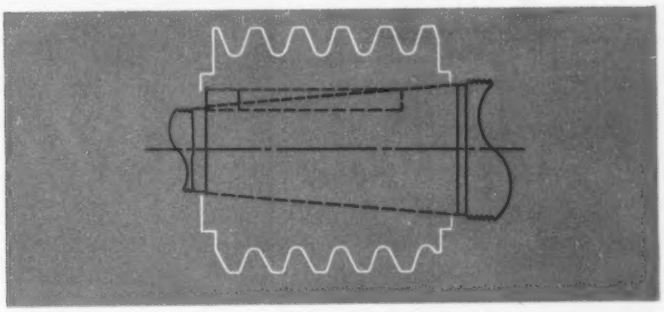
DESIGNERS OF STANDARD AND SPECIAL

MADE IN
ROCKFORD...A CONVENIENT SOURCE FOR PRODUCTION NEEDS
ILLINOIS, U.S.A.

TAPER HOLE HOBS AID ACCURACY CONTROL

Runout can destroy most of the inherent accuracy of a hob. As a further step in accuracy control, Barber-Colman Hob Engineers have developed hobs with taper bores. They are recommended for all Class AA Hobs, and for all hobbing jobs where accuracy is paramount.

Where high accuracy requirements are demanded it is much easier to true hobs with the taper bore mounting. Compared with the sliding contact on straight hole hobs, the taper provides metal-to-metal contact, eliminating the possibility of an increase in runout during the cutting operation. Also, much time is saved by the operator because the hob will run as true as the spindle.



TAPER BORES PROVIDE TRUE CENTERING ACTION

Production-line accuracy in all metal cutting operations is constantly approaching closer limits. Gear hobbing is perhaps the outstanding example. When you have gear tooth problems be sure to ask Barber-Colman Hobbing Engineers to work with you. One of the longest experiences in gear cutting is available to you without cost or obligation.

Write for a copy of Hobbing Notes — "Hobbing Accurate Gears"

HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

BARBER COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT, 711 ROCK STREET, ROCKFORD, ILLINOIS, U.S.A.

METAL CUTTING TOOLS SINCE 1908

MADE IN
CENTER OF MACHINE TOOL EXCELLENCE...ROCKFORD
ILLINOIS, U.S.A.

Downtime BECOMES *Production Time*

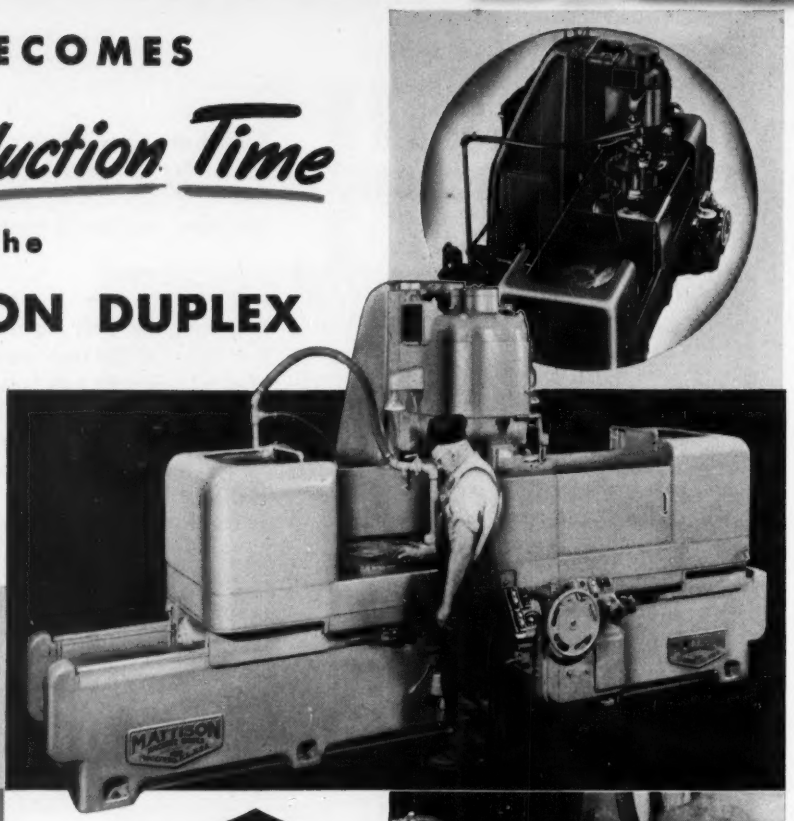
with the

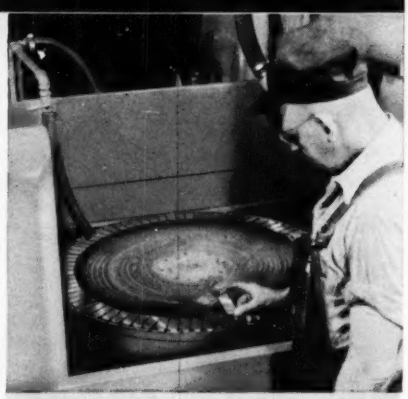
NEW MATTISON DUPLEX

Take a look at **THIS**

~~2 Operators~~
~~2 Standard Grinders~~
~~500 Pieces~~

1 Operator
1 Mattison Duplex
500 Pieces





● That's what happened at The Ingersoll Milling Machine Co., where modern shop equipment is playing an important part in meeting greatly increased requirements for Ingersoll milling cutter blades.

They say "The pieces being ground in these pictures are Maxel steel shanks for carbide-tipped milling cutter blades.

On these particular blade shanks, .050 stock is removed on the Mattison Duplex. A wide variety of blades and shanks are ground on this machine, with stock removal ranging from .020 to .200.

The two Mattison Duplex machines which replaced three single-table standard type grinders are doing more work than the three replaced machines. By placing a single ring of blades around the outside of the 30″ diameter chuck, the operator is able to maintain continuous grinding. If more blades were put on the table at one time, the blades on the other table would be finished before he was ready to unload them.

The time saving in rough grinding these blades on the new Duplex machines is 50 per cent, compared with the old machines. In other words, 500 blades can be produced in half the time formerly required. Greater power and faster action account for some of this difference.

The new Mattison Duplex Grinder is really two machines in one, being equipped with two rotary tables or chucks instead of one. On many classes of work, one operator with this machine can turn out as much work as was formerly done by two machines and two operators. See example to the left. Downtime is practically eliminated.

An analysis of your grinding work will very likely disclose many jobs that could be very profitably handled on a Mattison Duplex. For further information write for a free copy of 145-3RM our new circular on this machine.

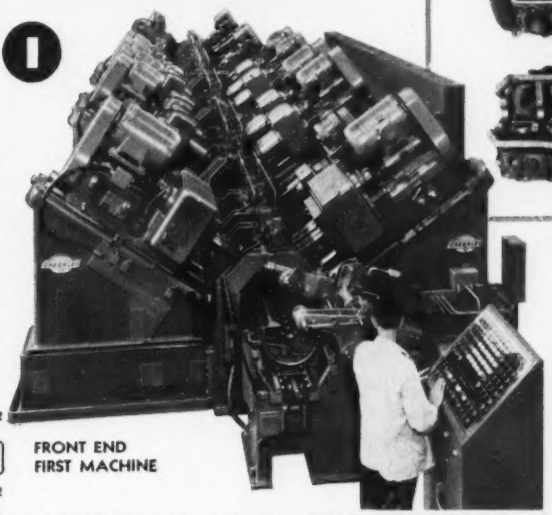
MATTISON MACHINE WORKS

ROCKFORD · ILLINOIS

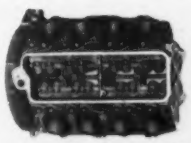
MADE IN
ROCKFORD...CITY OF MACHINE TOOL SPECIALISTS
ILLINOIS, U.S.A.

GREENLEE

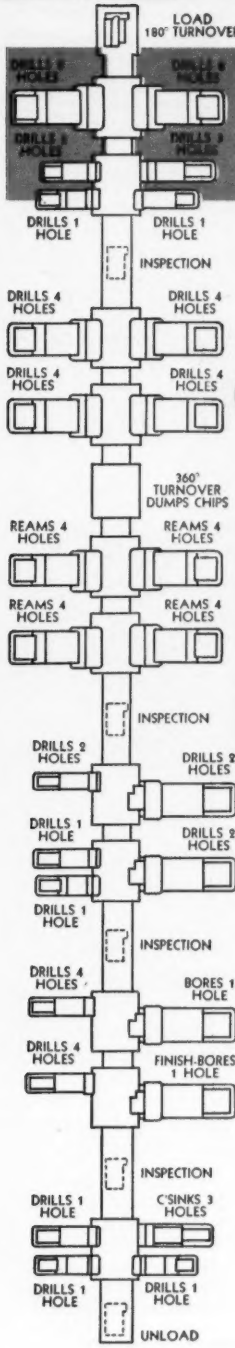
TRANSFER MACHINES

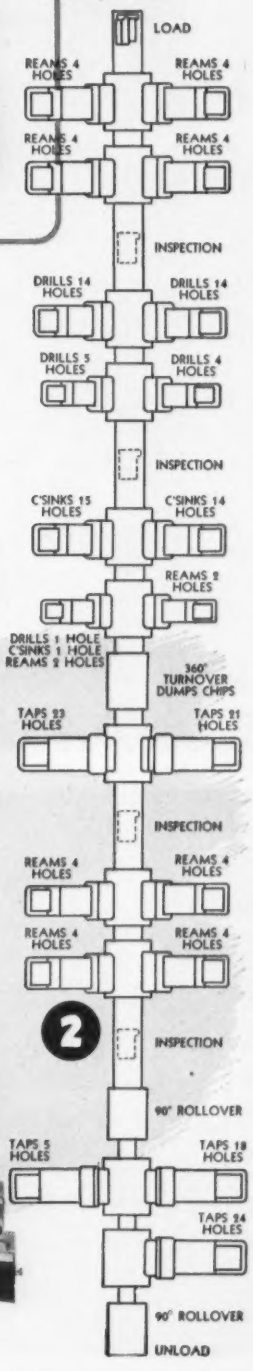


FRONT END
FIRST MACHINE



NEW V-8 BLOCKS

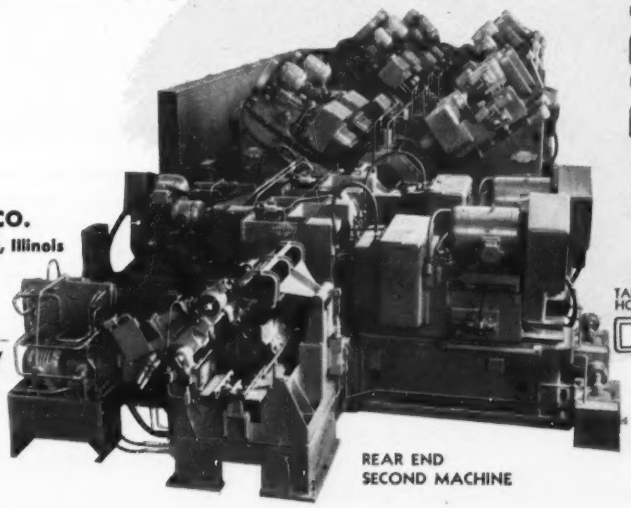




PERFORM 289 OPERATIONS ON V-8 CYLINDER BLOCKS AT 75 BLOCKS PER HOUR

New tooling for a brand new V-8 motor includes three lines of Greenlee Automatic Transfer Machines similar to the units illustrated. Each 2-machine line performs 289 operations on cylinder blocks during a 45-second cycle.

Sound construction, proved engineering, and a background of experience in building special machinery that dates back to 1918 assure you profitable, trouble-free operation.



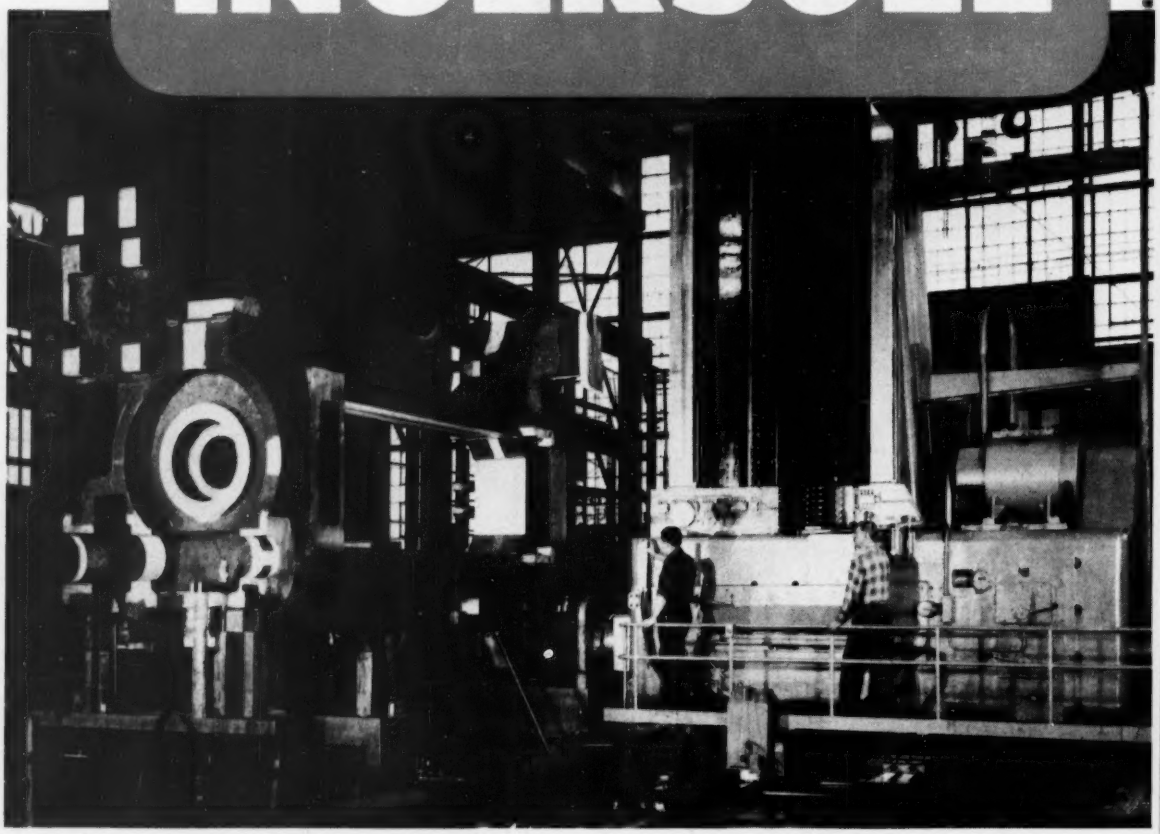
REAR END
SECOND MACHINE

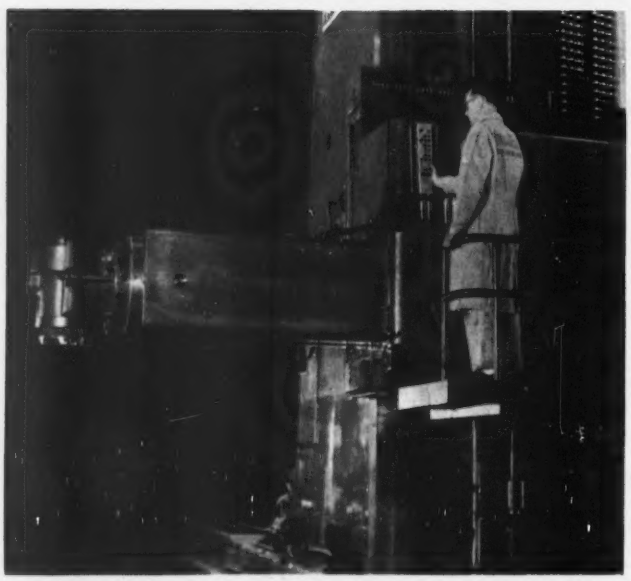
GREENLEE BROS. & CO.
1861 Mason Ave., Rockford, Illinois

PRODUCTION MACHINERY
GREENLEE

MADE IN
YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN...ROCKFORD
ILLINOIS, U.S.A.

INGERSOLL

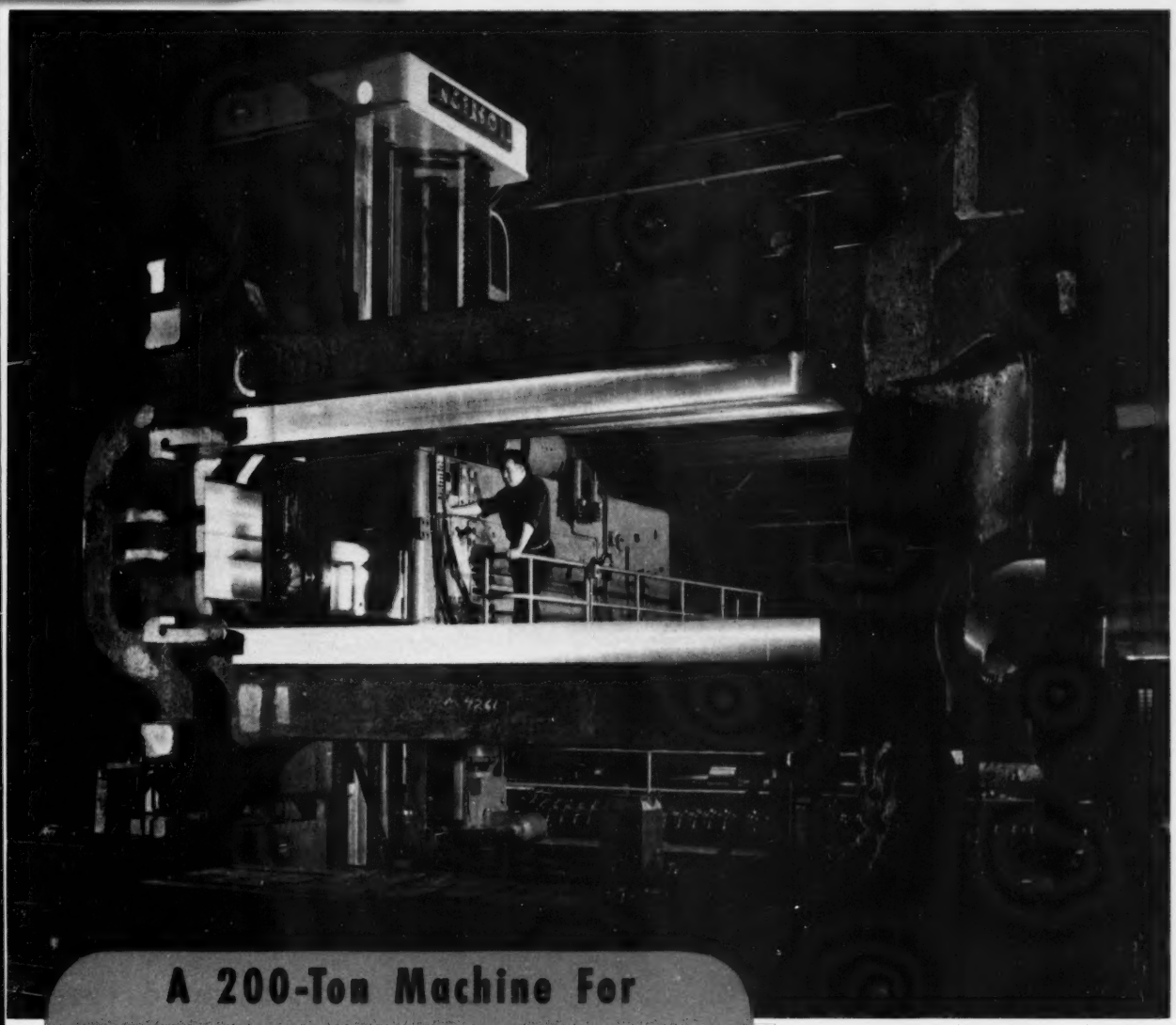




75 HORSEPOWER FOR CARBIDE, power clamping of head and housing, separate feed systems for housing, head and ram help to make the machine highly productive.

24-INCH-SQUARE RAM with right-angle attachment
Rigidly supports cutters working 6 feet from the milling head. All four faces of window opening and one side of housing are machined in one setting. Attachments and cutters were recommended and built by Ingersoll.

MADE IN
ROCKFORD...FOR MACHINES DESIGNED TO SUIT YOUR PRODUCTION
ILLINOIS, U.S.A.



A 200-Ton Machine For HEAVY CARBIDE MILLING On Large Rolling Mill Housings

Customer's Previous Time Cut in Half

MILLING AN 81-TON CASTING—Push buttons and dials on portable pendant give the operator full control from any position.

This 200-ton Ingersoll Special Design Ram-Type Traveling Housing Milling and Boring Machine produces rolling mill housings in less than one-half the customer's former time, and to greater accuracies.

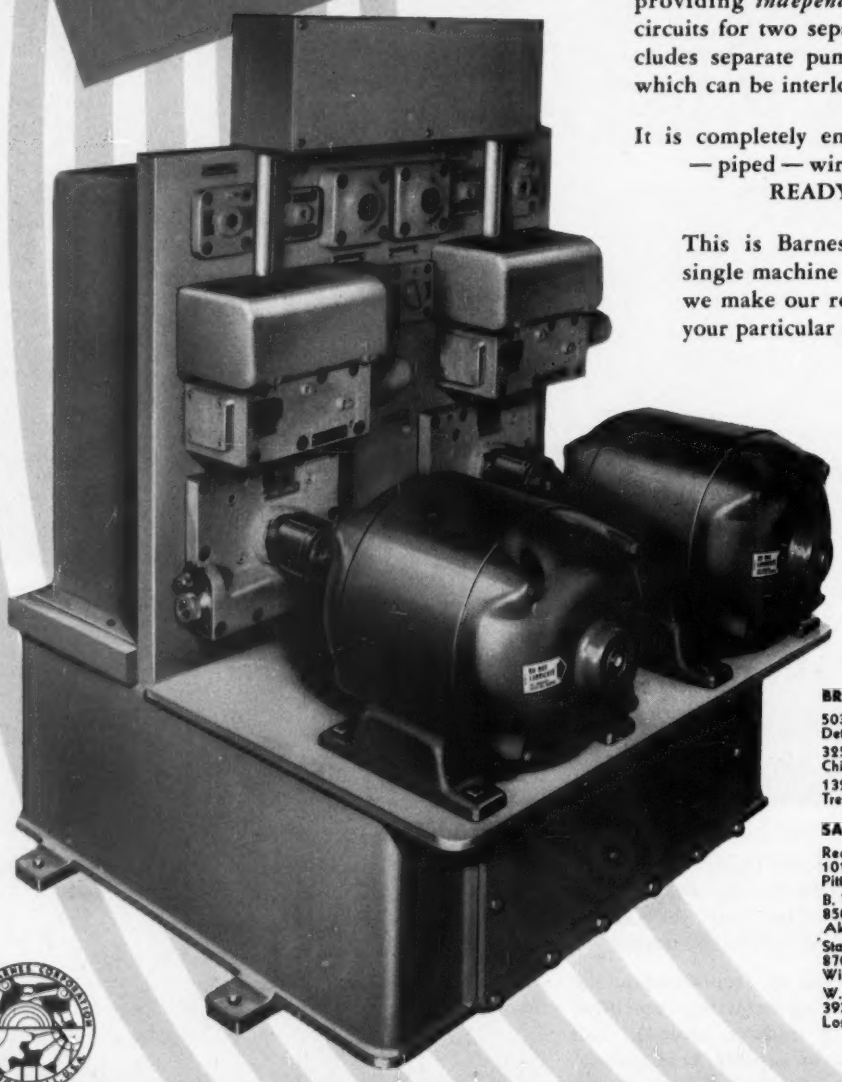
The machine has to be large to accommodate the work, yet it must be quick-acting and easily controlled so that many different face milling, slotting, and boring operations can be done rapidly. It is particularly adapted to the customer's present class of work, yet retains flexibility to meet unpredictable future requirements.

The experience we have gained in studying the production problems of customers in many kinds of manufacturing operations and building machines and cutters to meet them is our greatest asset. It is available to you.

THE INGERSOLL MILLING MACHINE COMPANY • ROCKFORD, ILL.

MADE IN
FOR PRODUCTION MACHINE TOOLS IT'S...ROCKFORD
ILLINOIS, U.S.A.

Barnes J.I.C. CODE MACHINE TOOL POWER UNITS



Illustrated is a Barnes Fluid Power Unit providing *independent* feed and traverse circuits for two separate spindle heads. Includes separate pumps, and control valves which can be interlocked electrically.

It is completely engineered — assembled — piped — wired — and tested — READY TO GO!

This is Barnes' solution to one single machine tool problem. May we make our recommendation for your particular needs?

INDUSTRIAL and AUTOMOTIVE HYDRAULICS

BRANCH OFFICES

503 New Center Building
Detroit 2, Michigan

3254 Lincoln Avenue
Chicago 13, Illinois

132 East Hanover Street
Trenton 8, New Jersey

SALES REPRESENTATIVES

Rees Machinery Company
1012 Empire Building
Pittsburgh 22, Pennsylvania

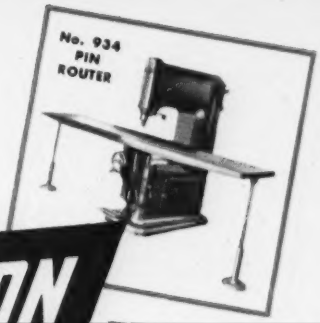
B. W. Rogers Company
850 South High Street
Akron 9, Ohio

Standard Machine & Tool Co.
870 Ottawa Street
Windsor, Ontario, Canada

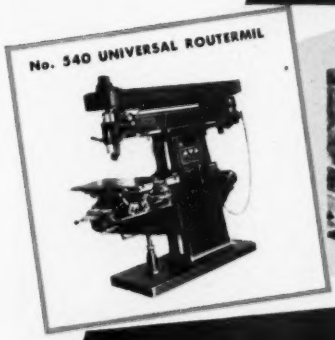
W. H. Sel Mar Co.,
3931 W. Slawson Ave.
Los Angeles 43, California

JOHN S. BARNES CORPORATION • 305 S. WATER ST., ROCKFORD, ILLINOIS

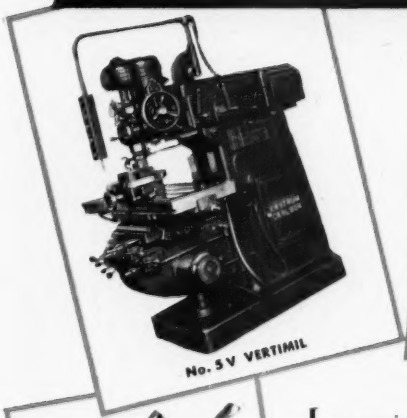
MADE IN
ROCKFORD...MACHINE TOOL PLANTS CLOSE TO YOUR PLANT
ILLINOIS, U.S.A.

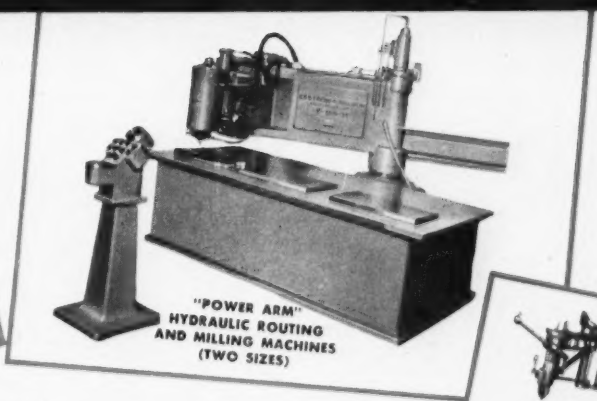


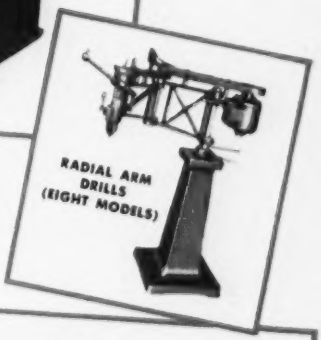
EKSTROM, CARLSON



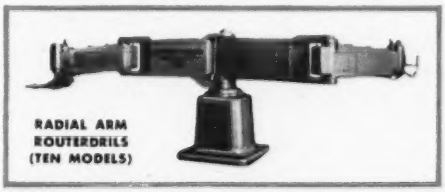
HIGH-PRODUCTION MACHINE TOOLS

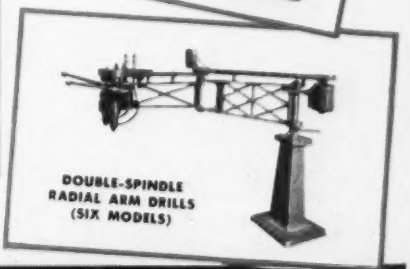






In practically every metal-working shop there is a place for one or more of these machines and tools. Keep a sharp eye on EKSTROM, CARLSON . . . for *brand new* and startling ideas in machine tools and high-production equipment.





Write for Literature:

Ask for our latest Bulletins on any of these products that interest you, and watch for announcements of new developments.

ECCO

EKSTROM, CARLSON & CO. 1400 RAILROAD AVE., DEPT. M-4, ROCKFORD, ILL.

MADE IN

FOR METAL REMOVAL WITH ACCURACY AND SPEED... **ROCKFORD**

ILLINOIS, U.S.A.

HANDLE TOUGH JOBS EASILY with ROCKFORD HYDRAULIC SLOTTERS

Rockford Hydraulic Slotters are your easiest method of machining large irregular pieces, internal surfaces, and angular or rotary cuts.

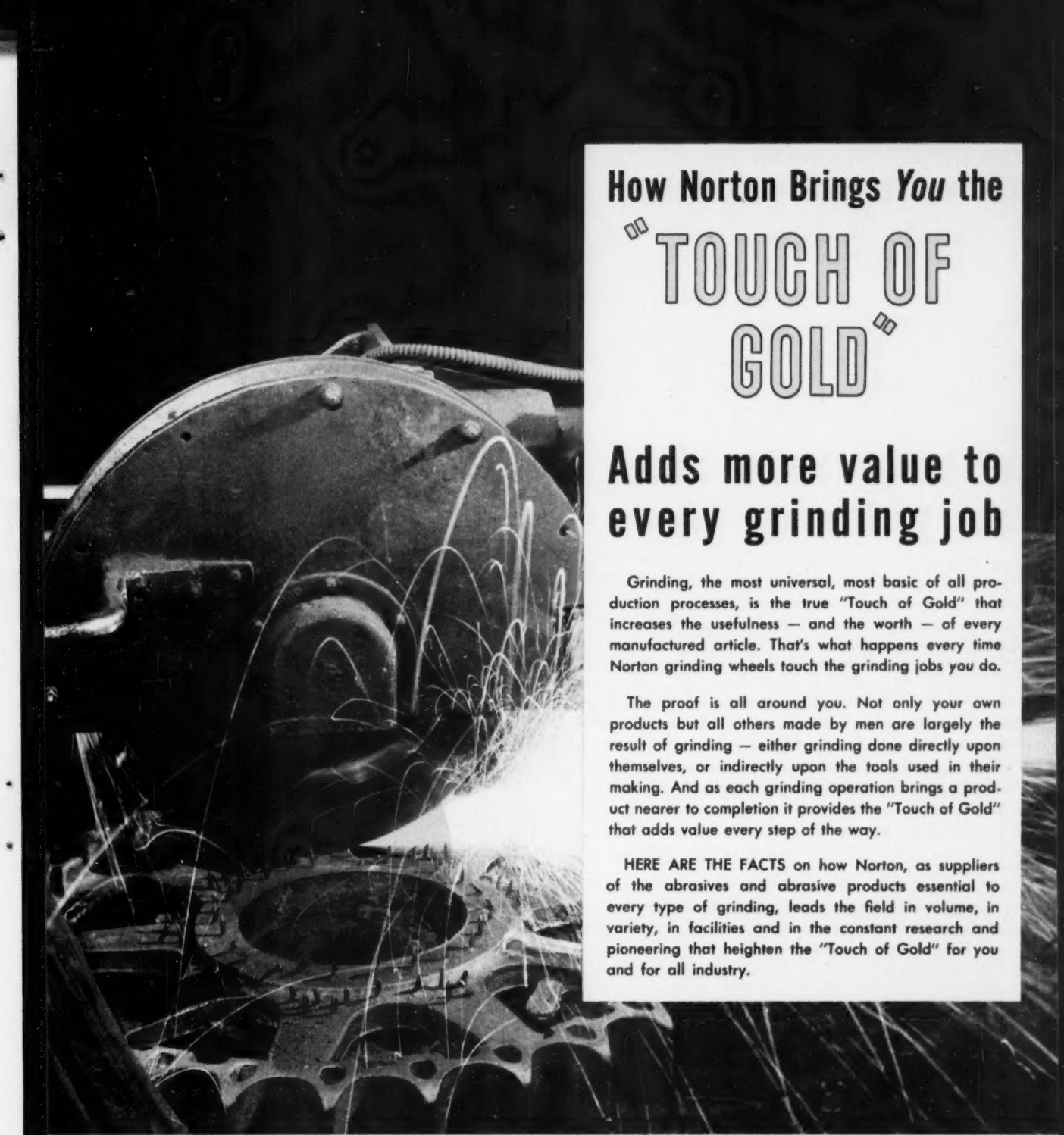
Rockford Slotters sharply reduce cutting time on your cumbersome jobs. Setups are quick and simple. Hydraulic cross, circular and longitudinal feeds give you maximum slotter flexibility. And Hydraulic drive supplies constant speed, simply selected.

Ask a Rockford Machine Tool Co. representative to recommend the Rockford Slotter for your needs.

Hy-Draulic

ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

MADE IN
ROCKFORD...A CONVENIENT SOURCE FOR PRODUCTION NEEDS
ILLINOIS, U.S.A.



How Norton Brings *You* the

"TOUCH OF GOLD"

Adds more value to every grinding job

Grinding, the most universal, most basic of all production processes, is the true "Touch of Gold" that increases the usefulness — and the worth — of every manufactured article. That's what happens every time Norton grinding wheels touch the grinding jobs you do.

The proof is all around you. Not only your own products but all others made by men are largely the result of grinding — either grinding done directly upon themselves, or indirectly upon the tools used in their making. And as each grinding operation brings a product nearer to completion it provides the "Touch of Gold" that adds value every step of the way.

HERE ARE THE FACTS on how Norton, as suppliers of the abrasives and abrasive products essential to every type of grinding, leads the field in volume, in variety, in facilities and in the constant research and pioneering that heighten the "Touch of Gold" for you and for all industry.

NORTON
ABRASIVES

Making better products to make other products better

"NORTON CITY"

World Headquarters for your

TOUCH OF GOLD

in Grinding

FIRST IN SIZE At "Norton City", the world's largest, most modern abrasive manufacturing center, you'll find over a mile of buildings and thousands of skilled workers. This big, bustling community ships out more abrasives and abrasive products, to all parts of the globe, than any other single source. Here also is located the newest and finest grinding machine plant ever built. And here, at the famous Norton School of Grinding, a constant stream of men — including many customers' employees — receive valuable instruction in every type of grinding wheel application.

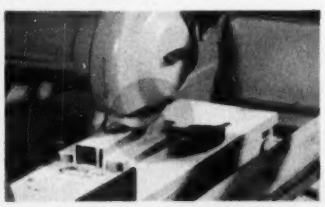
FIRST IN RESEARCH Research is the guiding spirit at Norton. Over 100 trained scientists and technicians, in 19 specialized laboratories, are constantly exploring every phase of abrasive product improvement and application. For the "Touch of Gold" that will solve your own grinding difficulties, look to the organization that leads all others in the number and value of original developments. Look to Norton!

FROM NORTON RESEARCHES LIKE THESE... COME "TOUCH OF GOLD" EXCLUSIVES LIKE THESE

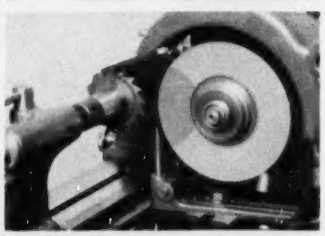
Abrasives and Bonds are microscopically examined under both plain and polarized light, in the Petrographic Laboratory.

Musical Pitch, or "ring" of a wheel is measured in the Physical Chemistry Laboratory, to determine certain characteristics.

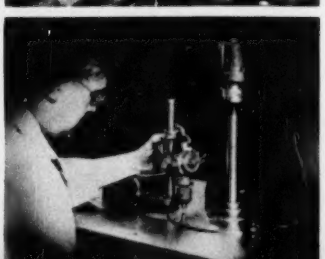
Constant Checking and testing of raw materials is one of the important functions of the Analytical Laboratory.



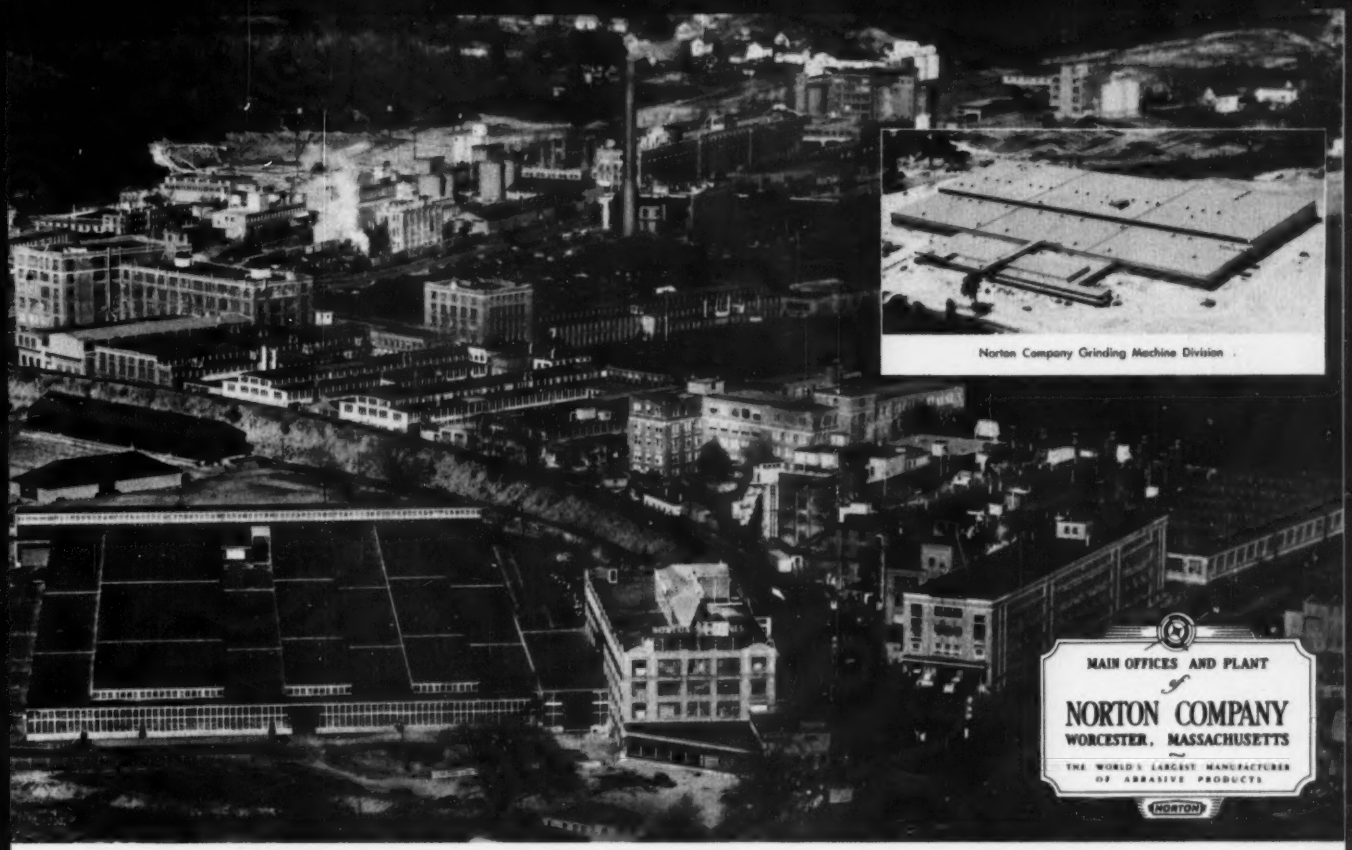
Norton New-Process Wheels are unequalled for uniform structure, identical performance and long, even wear.



32 ALUNDUM* Abrasive is a revolutionary Norton advancement. 32 ALUNDUM wheels cut both faster and cooler.



NORBIDE* Abrasive, hardest man-made material, replaces diamond dust in many lapping jobs, at fractional cost.



FIRST IN PRODUCT VOLUME AND VARIETY

More Products for Better Grinding . . . More Grinding at Lower Cost

Norton offers you the widest choice of abrasive products — all manufactured to strictest quality control standards — the quickest, surest way to the grinding results you want. Norton ALUNDUM abrasives and Norton CRYSTOLON* abrasives, together with Norton-developed bonds, make available hundreds of thousands of different grinding combinations, covering every known grinding requirement.

That's why you can always count on getting the *right* Norton wheels for every grinding job you do.

Make Sure
YOUR Grinding
Gets the Top
Value-Adding

"TOUCH OF GOLD"

with Norton Abrasive Products

For: Rough Grinding • Surface Grinding • O. D. Grinding • Cutting-Off • Polishing and Lapping • Tool and Cutter Grinding • Internal Grinding • Disc Grinding • Die and Mold Grinding • Barrel Tumbling

NORTON ABRASIVES

Making better products to make other products better

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

and NORTON is FIRST in SERVICE, TOO

You've read how Norton makes exactly the wheels you need to put the cost-cutting, value-adding "Touch of Gold" into your grinding.

Here's how you can be sure of getting those wheels — whenever you want them, wherever you're located.

1. YOUR NORTON ABRASIVE ENGINEER is located conveniently near you. He's a trained technician, skilled in every detail of grinding wheel manufacture and application. And he's ready to go into your plant, study your grinding problems and help you find the money-making answers.

2. YOUR NORTON DISTRIBUTOR is your local, direct connecting link with the entire Norton organization. A topnotch, factory-trained grinding wheel man, with plenty of practical experience in everyday grinding problems, can give you valuable help in selecting the right Norton wheels. And you can always count on your Norton distributor for adequate stocks, selected to meet the particular needs of your area.

3. NORTON BRANCH WAREHOUSES located in Chicago, Cleveland, Detroit, Philadelphia, and Pittsburgh, are backed by the huge stocks at Worcester. Each of these stocks is a vital nerve center in the Norton distribution system — each is an additional guarantee that Norton Service matches Norton Engineering in bringing you the "Touch of Gold" that means more profitable grinding for you.

NORTON COMPANY

Worcester 6, Massachusetts

DISTRIBUTORS IN ALL PRINCIPAL CITIES
SEE YOUR CLASSIFIED TELEPHONE DIRECTORY

EXPORT: Norton Behr-Manning Overseas Inc., Worcester 6, Mass.

NORTON
ABRASIVES

Making better products to make other products better

12-52

Printed in U.S.A.

"no more GAMBLING on tool steel selection"

[⅓ actual size; Selector is in 3 colors]

Here's how it works:

To use the Selector, all you need know is the characteristics that come with the job: type and condition of material to be worked, the number of pieces to be produced, the method of working, and the condition of the equipment to be used.

FOUR STEPS—and you've got the right answer!

1. Move arrow to major class covering application
2. Select sub-group which best fits application
3. Note major tool characteristics (under arrow) and other characteristics in cut-outs for each grade in sub-group
4. Select tool steel indicated

That's all there is to it!

Here's an example:

Application—Deep drawing die for steel

Major Class—Metal Forming—Cold

Sub-Group—Special Purpose

Tool Characteristics—Wear Resistance

Tool Steel—Airdi 150

One turn of the dial does it!

And you're sure you're right!

That's what one of the thousands of pleased users says about his CRUCIBLE TOOL STEEL SELECTOR, the new, simple, handy method of picking the right steel, *right* from the start. Since Crucible announced this Selector two years ago, thousands of tool steel users have received their Selectors . . . and here's what some of them say—

"Handiest selector I've ever seen!"

"Saves me time and headaches"

"It's so logical—you begin with the application".

You can be sure the answer you get with your Crucible Tool Steel Selector will be just right in every case, for this Selector covers 22 tool steels which fit 98% of all tool steel applications. And when—with a flip of the round dial—you get the answer, you'll get the steel FAST, too, because all the tool steels on the Selector are right in stock, in all our 26 conveniently-located warehouses.

This Selector is bound to be a big help to you—so write for yours today. There is no obligation whatsoever. Just fill in the coupon and mail now . . . before you turn this page and forget! CRUCIBLE STEEL COMPANY OF AMERICA, Chrysler Building, New York 17, New York.

Crucible Steel Company of America
Dept. M, Chrysler Building, 405 Lexington Avenue
New York 17, N. Y.
Gentlemen:
Sure! I want my free CRUCIBLE TOOL STEEL SELECTOR!

Name_____ **Title**_____

Company_____

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CRUCIBLE first name in special purpose steels

TOOL STEELS

52 years of Fine steelmaking

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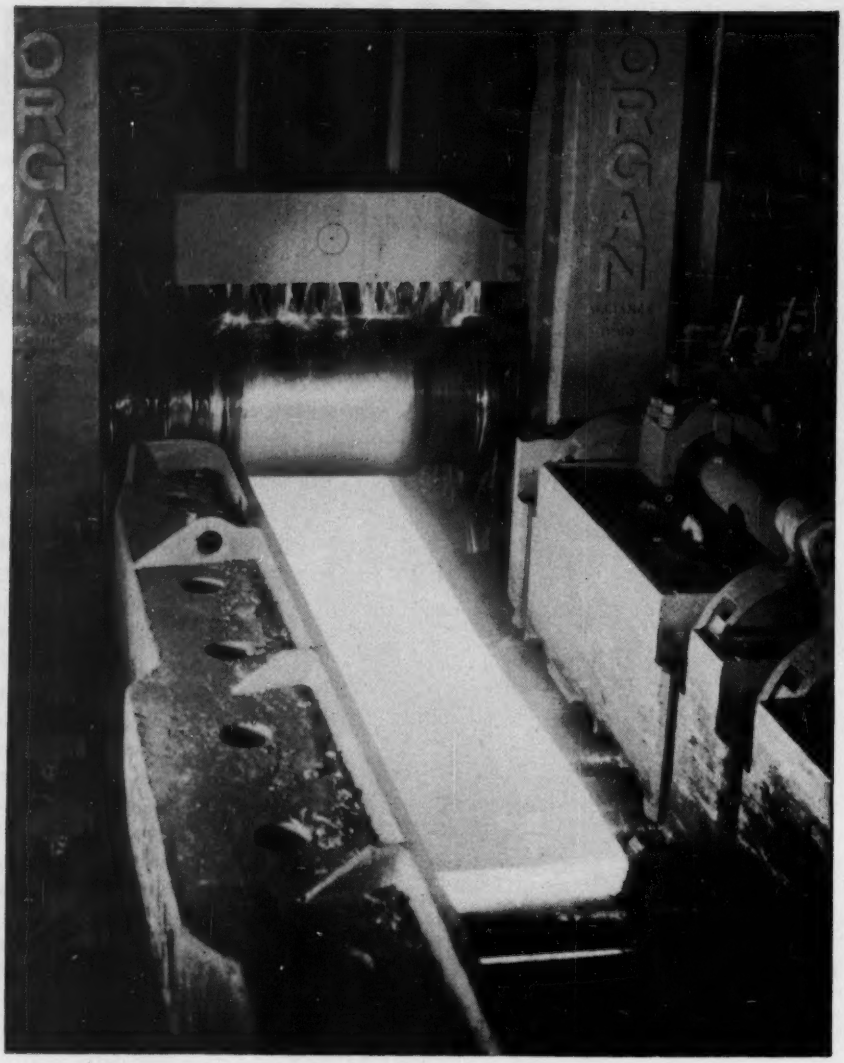
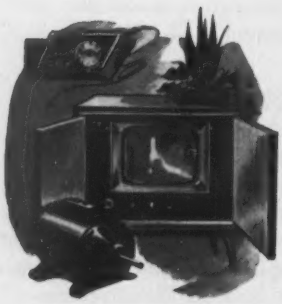
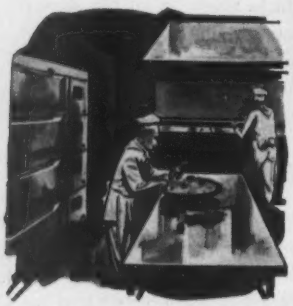




SPECIAL ELECTRICAL ALLOYS



CORROSION and HEAT-RESISTANT STEELS

TOOL and DIE STEELS

Coming at you —

One of the Royal Family of Steel

Our niche in the economic health of this nation in peace, and its defense in war, is to develop and produce the high-alloy steels and other special alloys which will do what ordinary metals cannot even approach in resisting corrosion, heat and wear, and in performing vital electrical and electronic chores. Whenever you have problems in these fields, the place to come is **Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.**

PIONEER in Specialloy Steels

Allegheny Ludlum

AL
TIME-TESTED STAINLESS STEEL

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Steel Makers • Forgesmiths • Heat Treaters • Machinists • Testing Equipment & Machinery Manufacturers

STEEL FORGINGS

(FLAT DIE)

For Industry

NATIONAL FORGE AND ORDNANCE COMPANY

IRVINE, WARREN COUNTY, PENNSYLVANIA

CUMBERLAND GROUND BARS

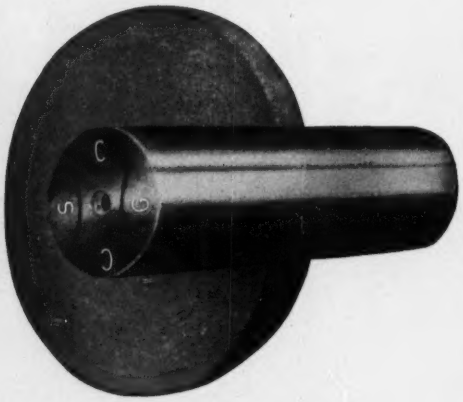
We manufacture 8" diameter, 7-1/2", 7", 6-1/2", 6", and also odd and intermediate sizes down to and including 1-1/8".

ON THE WEST VIRGINIA SHORE, OVERLOOKING THE POTOMAC RIVER, STANDS THE JAMES RUMSEY MONUMENT

The first practical steamboat in the world was run on the Potomac River a few miles below Cumberland, Maryland.

GEORGE WASHINGTON said in his diary, under date of September 6, 1784: "Remained at Bath all day and was showed the Model of a boat constructed by the ingenious Mr. Rumsey, for ascending rapid currents by mechanism; the principles of this were not only shown, and fully explained to me, but to my very great satisfaction, exhibited in practice in private under the injunction of secrecy—."

At a later date GEORGE WASHINGTON said in his diary: "Spent the afternoon with Mr. Rumsey and then Alexander Hamilton and I rode on to Cumberland, Maryland."



Symbol of Quality

Approximately 100 years after the exhibit of this steamboat, Cumberland began grinding bars. They found through experience this was the best method by which accurate steel bars could be produced. These bars are so carefully ground that they are adapted for mass production where gears, pulleys, sprockets and bearings must slide on the bars without delay due to filing or fitting.

IMMEDIATE BARS

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CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U. S. A.
ESTABLISHED 1845 **INCORPORATED 1892**

ORTMAN-MILLER SAYS . . .

WARPAGE AND BENDING ELIMINATED

MACHINING SPEED INCREASED 20%

WITH GROUND AND POLISHED

STRESSPROOF®

SEVERELY COLD-WORKED, FURNACE-TREATED STEEL BARS

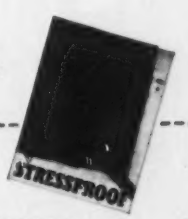
This piston rod, made by Ortman-Miller Machine Co., Hammond, Ind., for their hydraulic cylinders, is machined from Ground and Polished STRESSPROOF.

When this piston rod was made from C1018, Ortman-Miller had trouble with warpage after machining, and with bending and wear in operation. By switching to Ground and Polished STRESSPROOF, warpage was eliminated and machining speed increased 20%. In addition, STRESSPROOF had the strength to prevent bending, and wear became no problem.

STRESSPROOF has improved quality and lowered costs in hundreds of similar applications because of its unique combination of four qualities in-the-bar: (1) *High Strength*, double that of ordinary cold-finished shafting; (2) *Machinability*, fully 50% better than heat-treated alloys of the same strength; (3) *Wearability*, without case hardening; and (4) *Minimum Warpage*. STRESSPROOF is available in cold-drawn or ground and polished finish.

STRESSPROOF makes a better part at lower cost.

SEND FOR . . .
Free Engineering Bulletin "New Economies in the Use of Steel Bars"



La Salle STEEL CO.

Manufacturers of the Most Complete Line of Carbon and Alloy Cold-Finished and Ground and Polished Steel Bars in America.

La Salle Steel Co.
1428 150th Street
Hammond, Indiana

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City_____ Zone____ State_____

For copper in any form—
For top-notch service—
Call Chase

CHASE

What kind of copper or copper alloy do you need? Free-cutting brass rod? Sheet and strip brass? Phosphor bronze for springs? Call your nearby Chase warehouse. We can supply you, subject to government controls, with the widest variety of brass or copper materials for production, maintenance or repair.

Many of our branches are equipped to slit, saw, or shear our metals or your own stocks to specifications.

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Albany†	Cincinnati	Houston†	Minneapolis	Pittsburgh	Seattle
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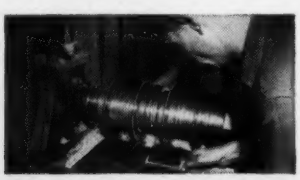
Baltimore	Dallas	Kansas City, Mo.	New Orleans	Rochester†	
Boston	Denver†	Los Angeles	New York	St. Louis	(†sales office only)
Chicago	Detroit	Milwaukee	Philadelphia	San Francisco	

Deliveries to your factory by truck, rail or express, if desired.



Close tolerance sawing, slitting, shearing to your specifications.

Stocks of tube, rod, bar, strip, sheet and wire in a variety of alloys.

If you make hollow parts, we'll give you the hole

THE center hole's already in Timken® seamless steel tubing. There's less time wasted on machining; you get more parts from each ton of steel you buy because there's less scrap.

Often, finish boring's the first step—screw machine stations can be used for other operations. You get greater machine capacity without adding machines.

Higher quality in your product is assured because the piercing process by which Timken steel tubing is made is essentially a forging operation. The tubing has a uniform spiral grain flow for greater strength and a refined grain structure which brings out the best in the quality of the metal.

And to help you save even *more* steel, the Timken Company's tube engineering service will study your problem and recommend the most economical tube size for your job guaranteed to clean up to your finished dimensions.

For further information on the uses of Timken seamless steel tubing, write The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

SHOP TIPS

New, Free Magnet Idea Kit for Shops

A handy new literature kit showing the hows and whys of permanent magnets is currently sparking shop men to real savings in time, money, effort.

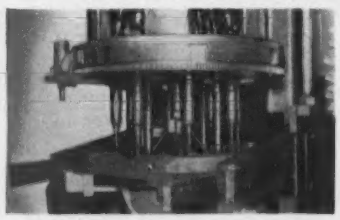
To date, the magnets have proved very effective as sheet steel separators, magnetic stands, tool-holding devices, sweepers' "pickup" tools, paper grippers and tool retrievers, to name a few uses.

Magnet Idea Kit can be obtained free from Carboloy Department of General Electric Co. (See address at right.)

★ ★ ★

Drill Cast Iron with Carbide Twist Drills

Drilling cast iron with carbide twist drills is definitely past the "maybe" stage. Users report doubled production, more than tripled drill life over



H.S.S. drills, without any special drilling equipment or job engineering. Sound, how-to-do-it technical bulletins available free. Write Carboloy Department of General Electric Co. (See address at right.)

★ ★ ★

New Masonry Drills Won't Stall, Pack

An outstanding advance in rotary drilling of masonry was recently unveiled in Carboloy oval-flute "Live-Spiral" Drills.

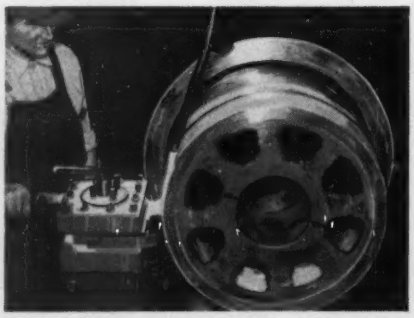
The drills, tipped with Carboloy cemented carbide, won't stall or pack even at very rapid speeds. They work equally well in concrete, brick, plaster, slate or asphalt. For full details write Carboloy Department of General Electric Company. (See address at right.)

YOUR CARBOLOY FIELD ENGINEER SAYS—

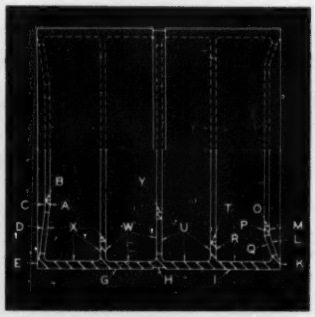
We can help you get swift tool-

Here's how one leading manufacturer quickly adapts low-cost Standard Carboloy Tools to his single-point tool machining operations – jobs that would normally require costly "specials" – and gets them on the jobs *in minutes*. No special grinding equipment. No delays or heavy inventories. By standardizing on "Standards," he gets full carbide benefits shop-wide – just as you can. Check these pages. Then send me blueprints of your tough single-point tool jobs. We'll show you how easily "Standards" can be best for you, too.

1 Gets 14 "specials" from these 4 styles of "Standards" – A large Midwestern manufacturer (name on request) needed 14 specially shaped tools for a rush job on cast steel gear blanks. From their stocks they selected the 4 Standard Carboloy Tool styles shown . . . ground them to the shapes needed in minutes per tool. No long waits for costly "specials," no extra expense or production delays. (See illustrations, below and on right-hand page.)

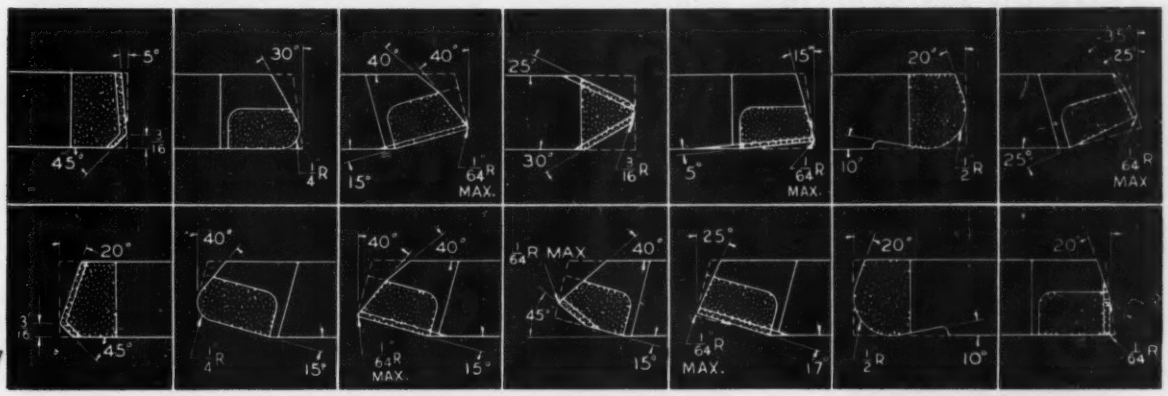


Here is the job – a tough steel casting 26" in dia., 23" wide, and requiring a wide variety of rough and finish turning, facing and boring operations.



Sketch of side view of part showing many of the single-point tool machining operations necessary for the job.

convert to Standard Carboloy Tools and ups, low inventories, lowest tool cost



Dotted lines show the original tip ends of the 4 styles of Standard Tools before they were ground to these 14 special shapes in minutes.

2 **Easy for you to use, also**—Adapting Standard Carboloy Tools to your special-tool needs is a cinch. They can be rough-ground quickly on ordinary silicon carbide wheels, finished economically on diamond wheels. Standard Carboloy Tools stay sharp up to 10 times as long as high-speed steel tools, last 10 times longer, too.

3 **You get quicker tool-ups** – You'll cut tooling delays to minutes instead of days or weeks with "Standards" on your shelves. Your inventories will be lower – costs, too. Just 11 styles of Standard Carboloy Tools can be adapted to do up to 80% of all your single-point tool machining.

4 **You enjoy plant-wide benefits** – Let us help you convert to standard styles of Carboloy Tools – for plant-wide benefits. Thousands of shops have done so . . . and now profit from such things as production gains of up to 300%, downtime savings that alone more than pay for the entire cost of the tools.

To get maximum performance from Standard Carboloy Tools, we have the industry's best all-around Carbide Service Program. Includes all types of free how-to-do-it technical data, a tuition-free training school, etc. For details, mail coupon today.

CARBOLOY TOOLS ARE STOCKED COAST TO COAST BY

AUTHORIZED CARBOLOY CEMENTED CARBIDE DISTRIBUTORS

Look under "Tools" in the Yellow Pages of your local telephone book, or in Thomas' Register, for address and phone number of your nearby Carboloy distributor, branch or district office.

"Carboloy" and "Live-Spiral" are registered trademarks of Carboloy Department of General Electric Company

5 **Send blueprints of your "specials"** – Let us review your single-point tool machining jobs that now require costly special tools . . . show you exactly what "Standards" can be adapted, and how. Send blueprints today to the factory at Detroit, or to your nearest Carboloy District Office. No charge or obligation. See coupon below.

MAIL COUPON TODAY!

CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY

11147 E. 8 Mile Blvd., Detroit 32, Michigan

Gentlemen: Please send me, at no cost or obligation, Carboloy General Tool Catalog, GT-250.

☐ Also, I am enclosing ( ) blueprints or sketches of the single-point tools we use. Show me, free of charge, which low-cost Standard Carboloy Tools can be quickly ground to these special shapes (and how to do it).

Name_____ Position_____

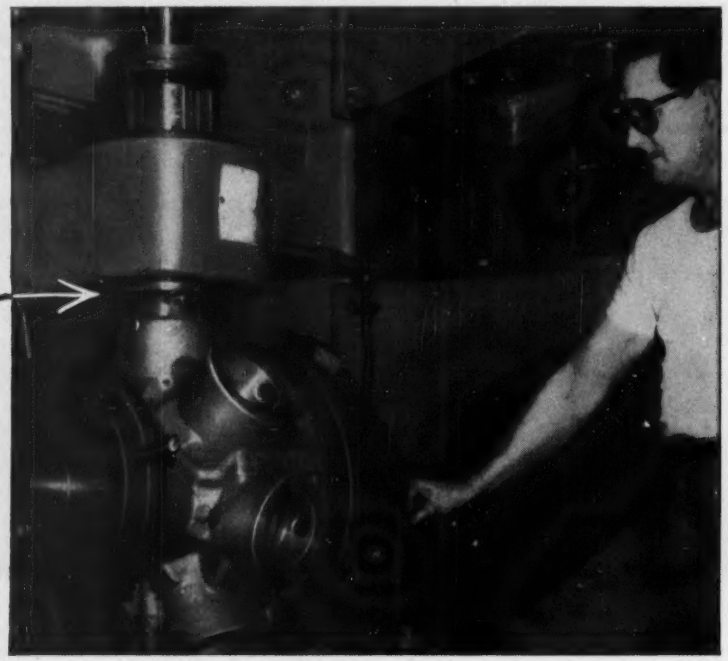
Company Name_____

Address_____

City_____ Zone____ State_____

2000 Cylinder Ports per Grind

because HAYNES STELLITE *tools resist* CHIPPING and SPALLING



This boring head, containing 20 HAYNES STELLITE inserted blades, operates for 4 to 6 weeks without grinding.

Here is how the HAYNES STELLITE blades are positioned in the boring head.

A multiple blade boring head containing 20 HAYNES STELLITE alloy inserted blades operates from 4 to 6 weeks without regrinding at a plant making refrigeration and air-conditioning equipment. The tools bore, chamfer, counterbore, drill, and face the cylinder ports in cast iron compressor heads. This is all done in one operation.

HAYNES STELLITE blades average over 2000 cylinders per grind even though machining is complicated by an intermittent cut at a gas outlet port in the cylinder wall. The tools are good for 25 regrinds—an average of 50,000 cylinders per cutter.

Tools made of HAYNES STELLITE alloy resist chipping and spalling—even on tough jobs like this one. This is one reason why the tools are easy to grind and can be reground so many times.

For information on how to use HAYNES STELLITE tools on your machining jobs, write for the booklet "HAYNES STELLITE Metal-Cutting Tools." It gives helpful information on chip formation, tool design and the machinability of metals.

HAYNES TRADE-MARK *alloys*

Haynes Stellite Company
A Division of
Union Carbide and Carbon Corporation
UCC
General Offices and Works, Kokomo, Indiana
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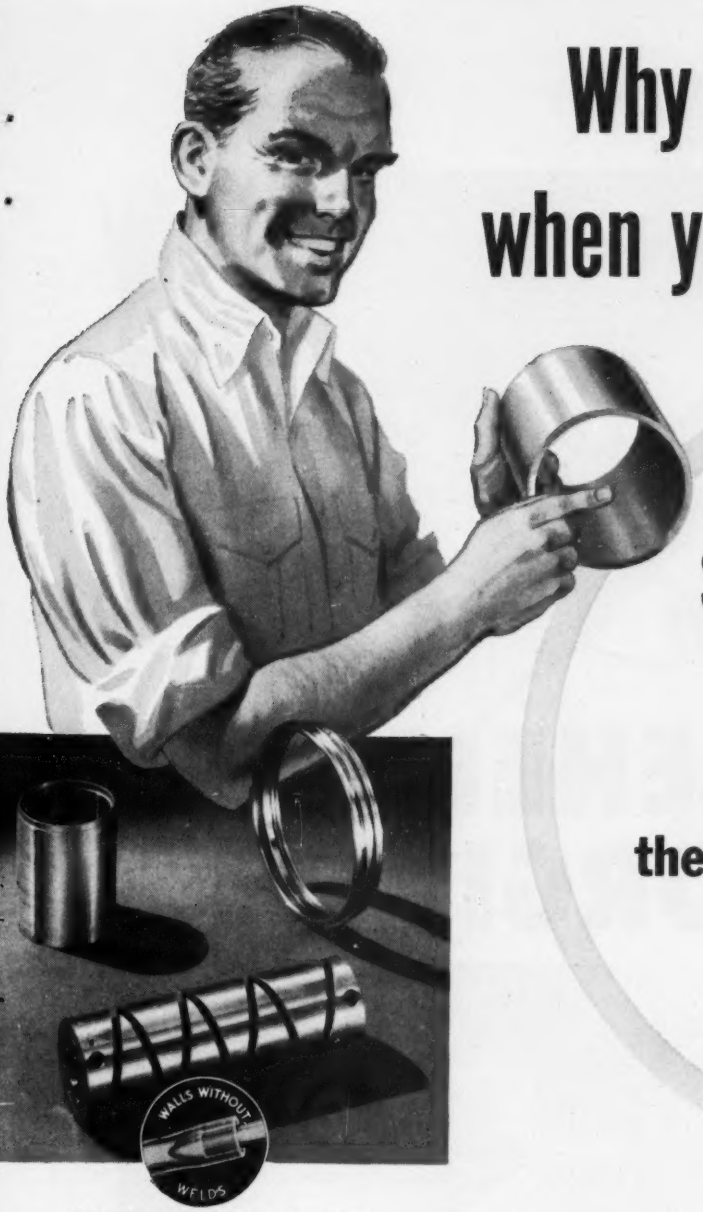
Chicago — Cleveland — Detroit — Houston
Los Angeles — New York — San Francisco — Tulsa

"Haynes" and "Haynes Stellite" are trade-marks of Union Carbide and Carbon Corporation.

Why bore a hole when you can buy it?



SHELBY SEAMLESS STEEL TUBING

comes to you with the hole and basic shape already made!

All Shelby Seamless Tubing is pierced from solid billets of uniform steel. This is the one manufacturing method that assures absolute uniform wall strength.

THIS FREE BOOK

tells how you can cut production cost and make better parts. Write for it today!

● It costs money to bore a hole through solid stock. It takes time. It wears out tools. It wastes steel. In other words, it's poor economy.

By using Shelby Seamless Mechanical Tubing you can eliminate or greatly reduce many time and labor consuming operations connected with boring and machining.

Shelby Seamless Tubing is available in a complete range of sizes; in different wall thicknesses; various finishes and steel analyses . . . with the basic shape already made . . . and with the hole built in.

Another important advantage in using Shelby Tubing is that its excellent machining characteristics and uniformity speed up production and improve the quality of your output. You can turn out parts by the millions and the last part will be as metallurgically and dimensionally accurate as the first.

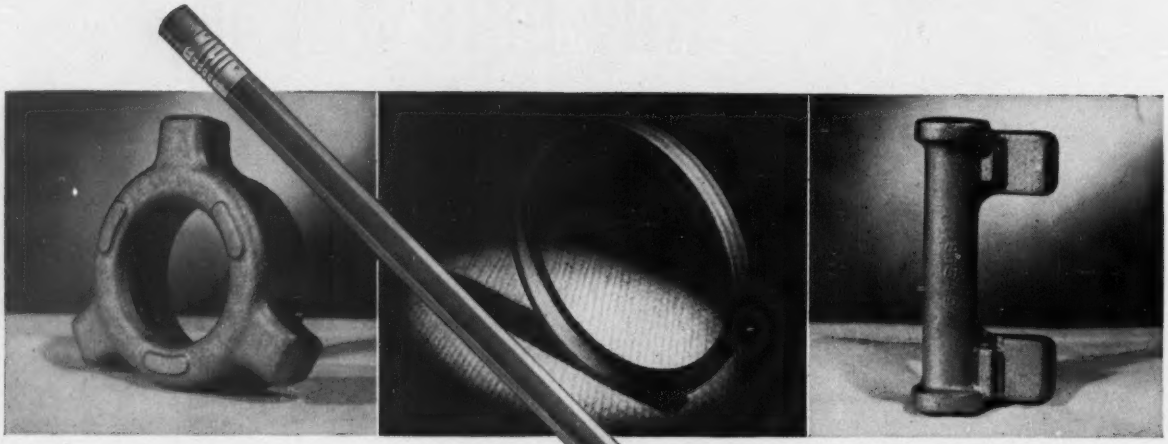
Why not talk to National's engineers about the economic advantages of using Shelby Seamless Tubing? You can be sure that any recommendations they make will be based on a thorough study of your particular requirements.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
(Tubing Specialties)
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

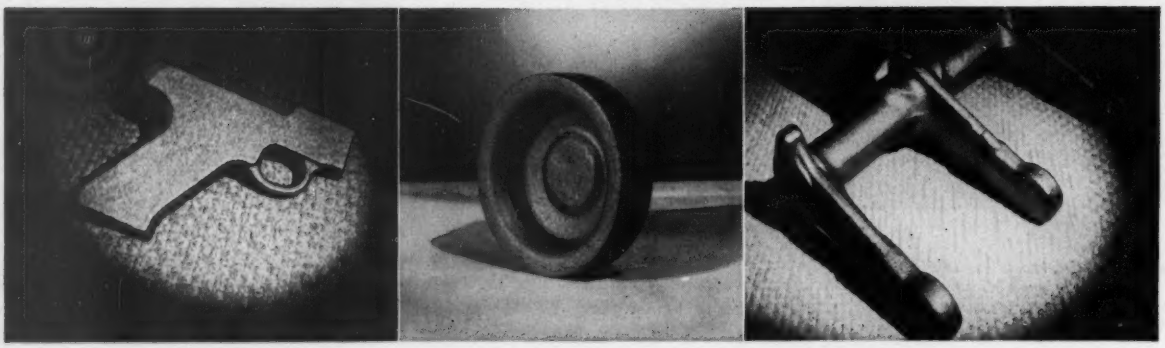
U·S·S SHELBY SEAMLESS MECHANICAL TUBING

UNITED STATES STEEL



Jot it down

BETHLEHEM *for* DROP FORGINGS



Our regular customers know we make drop forgings—good ones. But maybe you're with a company that hasn't yet tried our services. If so, jot us down on your "Where to Buy" list. We'd like to do business with you.

Bethlehem has much to offer. The necessary steel; a fine, well-equipped die shop; hammers, mechanical presses; heat-treating equipment; full metallurgical service to double-check quality.

We're an experienced firm; been making closed-die forgings for many years. These have included a wide range of designs for the oil, mining, aviation, automotive, electrical, and other types of industries. Call or write us, won't you? We'll bend over backward to meet your requirements and do a good job for you.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Which soils are hardest to remove?

WHAT METALS DO YOU CLEAN?

- ☐ buffing compound residues
- ☐ pigmented drawing compounds
- ☐ oils and greases
- ☐ heat scale
- ☐ tarnish
- ☐ rust, oxides
- ☐ carbon smuts
- ☐ flux residues
- ☐ rust preventives

from

- ☐ steel
- ☐ brass
- ☐ copper
- ☐ aluminum
- ☐ magnesium
- ☐ lead
- ☐ zinc

Can you electroclean brass without tarnishing? Do you find buffing compounds or carbon smuts hard to remove? Would you like to remove rust and oil in one cleaning operation?—You'll find real efficiency and economy in Oakite methods for metal cleaning. Tell us your problem and let us send you the FREE booklet.

Technical Service Representatives Located in Principal Cities of United States and Canada

SPECIALIZED INDUSTRIAL CLEANING

OAKITE

TRADE MARK REG. U.S. PAT. OFF.

MATERIALS • METHODS • SERVICE

OAKITE PRODUCTS, INC.
26 Rector St., New York 6, N. Y.

Tell me (without obligation) about Oakite methods for removing the following soils from the following metals: _____

_____

_____

☐ **ALSO** send me a **FREE** copy of your booklet *"Some good things to know about Metal Cleaning."*

Name _____

Company _____

Address _____

Here's a Challenging Opportunity for Every Man Responsible for Tooling and Production

Your *tools* and *dies* represent an immediate opportunity to bring unit costs down to a reasonable level. A quick re-check of this vital cost zone can result in definite savings. Sometimes these savings show up in less die finishing or adjusting. Or in longer runs with less downtime for regrinding. Many times they come about through a drastic reduction in the *number* of tools and dies you make each year.

Actual job records in plant after plant *prove* these cost economies can be realized. A good example is the job shown above. A re-check of these dies, used to blank and form .008" thick bronze thermostat diaphragms, showed that a different steel with better wearing qualities was needed to reduce excessive downtime for regrinding. This steel, Carpenter Hampden (Oil-Wear), eliminated *11* hours of machine downtime each week and produced over a half-million *extra* diaphragms per grind!

Certainly, if other plants are finding new output and production savings by re-checking their tools and dies, you can too. First step is to use The Carpenter Matched Set Method to select the one steel best suited for your job. By so doing, you back your selection with really dependable Carpenter Matched Tool and Die Steels. Then a call to your nearest Carpenter Mill-Branch Warehouse or Distributor brings fast delivery from stock. THE CARPENTER STEEL COMPANY, 105 W. BERN ST., READING, PA.

Are You Missing These Opportunities In Your Cost Relief Zone?

- Less die finishing and adjusting
- Greater output between grinds
- Fewer heat treating failures
- Less machine downtime

On Job After Job Carpenter Matched Tool and Die Steels Have Made Them Possible!

Carpenter STEEL — Matched Tool and Die Steels

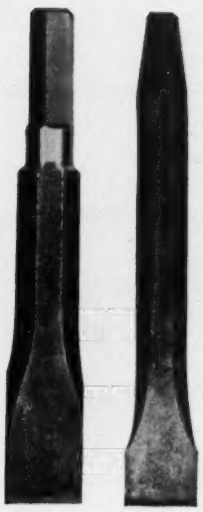
Export Department: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

Mill-Branch Warehouses and Distributors in Principal Cities Throughout the U. S. A. and Canada

Tool Steel Topics

BETHLEHEM STEEL

Which chisel has the better design?



Both these chisels, used in pneumatic chipping hammers, are made from shock-resisting tool steel (Bethlehem Omega). One of them consistently gives long service life, while the other is subject to breakage—due directly to its design.

Can you pick out the better design? Look at them carefully. It's the one on the right with the tapered shank.

You still see a lot of chisels designed like the one at the left, that's so susceptible to breakage. Even with the fillet between the round and octagon sections, this chisel is subject to fatigue-failures at the change of section. Stresses become concentrated there, causing premature fractures.

Shank failures are virtually unknown in chisels of the improved, tapered-shank design. The gradual taper prevents any dangerous concentration of stresses.

The comparison of these two chisels helps to explain why it takes more than just good tool steel to get the best performance out of tools and dies. It takes good tool design . . . correct heat-treatment . . . the right grinding technique . . . and proper application. But of course it takes the right grade of good tool steel, too!

Omega halts coupling breakage

Omega tool steel plays a vital role in the drilling of blast holes at the Scrub Oaks and Oxford Mines in the historic iron ore belt of Northern New Jersey. In drilling holes from 35 to 125 ft deep, rods of 1-in. hollow drill steel are joined by patented couplings developed by Ralph Catanzarita, drill-steel-shop foreman at Scrub Oaks mine.

When this method of drilling long holes was first tried, the frequent breakage of couplings was discouraging. Our salesman learned of the trouble and sold them on Omega. This shock-resisting grade did the trick. Coupling failures were reduced to about 1 in 500; and there hasn't been one case of stripped threads.

Omega is outstanding for chisels, and it does a swell job on other cold-shock tools: knockout pins, pawls, punches, swaging dies, clutch pins, shear blades, drive shafts, and machine parts subject to slam-bang shocks. Omega is a tool steel engineered to take the heaviest shocks in its stride. Its typical analysis:

C	Mn	Si	Mo	Va
.60	.70	1.85	.50	.25

It takes a really tough tool steel to take the shock and stress involved in coupling together rods of rock-drill steel. The coupling at left is unused. The one at the right has been used in drilling 1700 ft of blast hole in hard iron ore. The outside wearing surfaces have been worn down by the abrasive rock.

TOOLMAKER AT WORK—As this progressive die nears completion, the toolmaker checks dimensions carefully. The die is used to blank, punch and form lawnmower parts from 3/16-in. steel strip. It is made from Lehigh H, a high-carbon, high-chromium grade, and hardened to Rockwell C 60. When placed in service the die turned out about 30,000 pieces between grinds, operating in a 200-ton press.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Air-hardening steels should be quenched uniformly

What are the advantages of uniform quenching? First, a minimum of dimensional change or distortion; and second, a minimum of undesirable residual quenching stresses.

Here are some helpful points to remember when quenching air-hardening steels:

- Place the tool on a coarse-mesh screen to permit circulation of air on all sides of the tool.
- Turn over the tool at intervals to improve cooling-uniformity.
- Use a fan or a blast of dry air over the sections which cool most slowly. (Caution: *Too much* air will cause additional non-uniformity.)
- Sections of the tool which cool too rapidly can be wrapped in wire mesh to retard cooling.
- If one portion of the tool turns black long before other portions, you can be sure that it's not cooling uniformly.

For this Automobile Fan Shaft . . .

The right Republic Steel Saved

40% IN COST...

3 OPERATIONS...

3 INSPECTIONS...

AND 1 BIG HEADACHE

Here's another case where Republic Carbon-Corrected Bar Stock replaced a carburizing steel.

Before they switched to Republic Carbon-Corrected Steel Bar Stock for automobile fan shafts, Schwitzer-Cummins Company had been carburizing the steel shafts after machining. This ran up costs, created the headache of carburizing and inspecting, tempering and inspecting, cleaning and inspecting, and finally straightening warped shafts and inspecting.

The Schwitzer-Cummins metallurgist called on our Republic 3-Dimension Metallurgical team . . . the Field Metallurgist, backed up at home by the Laboratory and Mill Metallurgists. The decision was made to change over to Republic Carbon-Corrected AISI-C 1144 Bars. Now, induction hardening and inspection takes the place of the previous 8-step procedure. No warped shafts to straighten, and a better fan shaft that will last longer in your car or truck. Cost is reduced up to 40%.

The help our Republic 3-Dimension Metallurgical Service gave to Schwitzer-Cummins metallurgists is also available to you. It can help you make better products at lower cost. When shall we call?

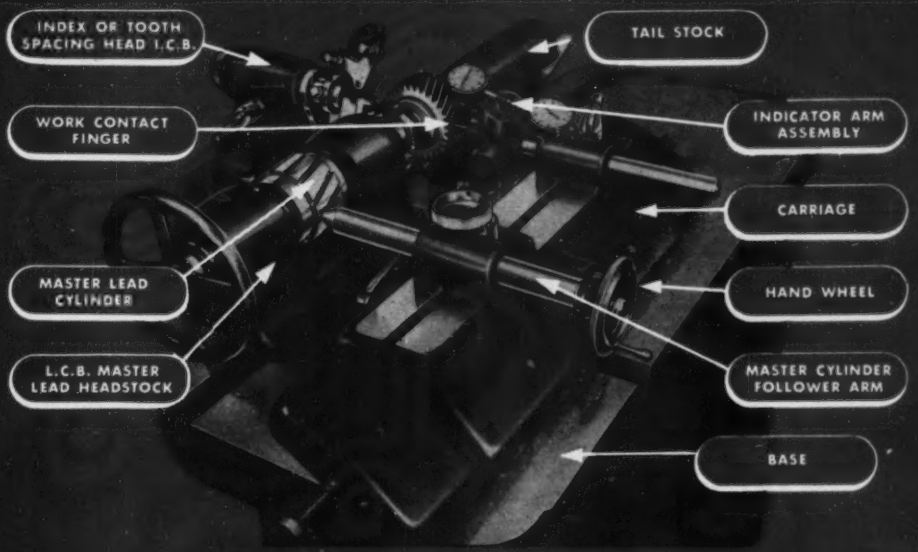
REPUBLIC STEEL CORPORATION
Alloy Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

LAB MILL FIELD
3-DIMENSION Metallurgical Service

Republic COLD DRAWN ALLOY STEEL BARS

REPUBLIC STEEL

Other Republic Products include Carbon and Stainless Steels—Sheets, Strip, Plates, Pipe, Bars, Wire, Pig Iron, Bolts and Nuts, Tubing



Red Ring Lead Comparator—slide assembly on the right of the work center with the L.C.B. index or tooth space checking head on the other side.

LOCATE AND EVALUATE GEAR ERRORS

QUICKLY and ACCURATELY

Errors in each of the several gear characteristics can be quickly analyzed and evaluated on the Red Ring Universal Gear Checker.

This instrument with 5 interchangeable heads indicates errors in tooth size, spacing, helix angle, lead, eccentricity, parallelism and wobble. This Checker is rugged enough for the production shop—sensitive enough for the gear laboratory—simple enough for the average shop man to use effectively. No special skill is required—ideal for the rapid inspection of mass-produced gears.

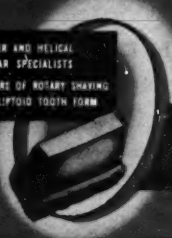
For more detailed information and specifications ask for Bulletin C-51-6.

Model SIC Head checks helix angle eccentricity and tooth size.

Model ECA Head checks eccentricity and tooth size.

Model CPA Head checks parallelism.

Head for checking helix angle wobble, eccentricity, ... and tooth size.



SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

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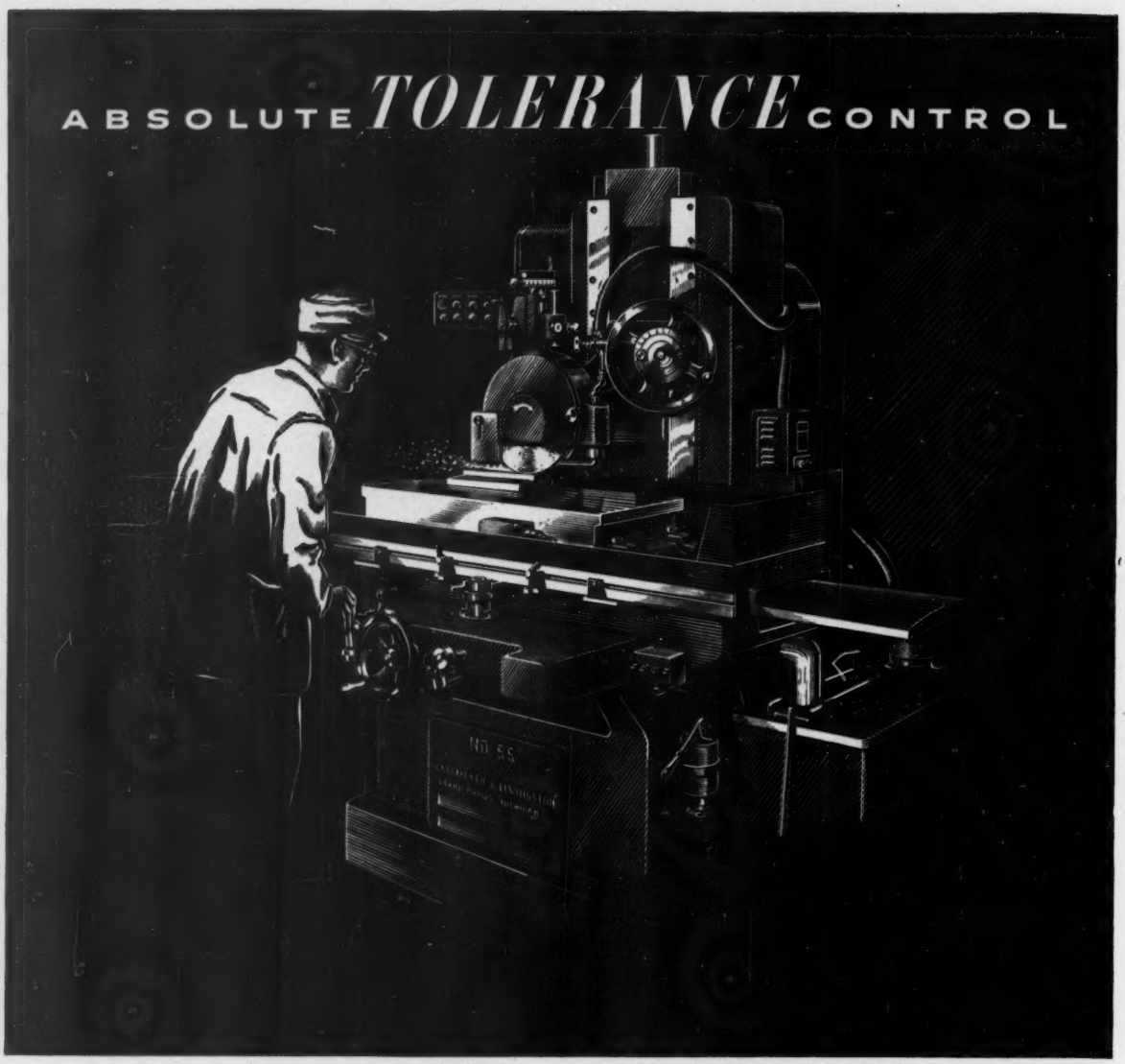
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

ABSOLUTE *TOLERANCE* CONTROL



When job specifications leave no leeway, when extreme tolerances must be maintained . . . that's when the built-in precision and absolute tolerance control of Grand Rapids Grinders proves most valuable. Defense commitments make it impossible for us to fill your orders as rapidly as we'd like to . . . but we know our customers can appreciate the reasons for delay. As always, we're doing our best to serve you.

GALLMEYER & LIVINGSTON CO.
305 Straight Ave., Grand Rapids, Mich.

GALLMEYER & LIVINGSTON

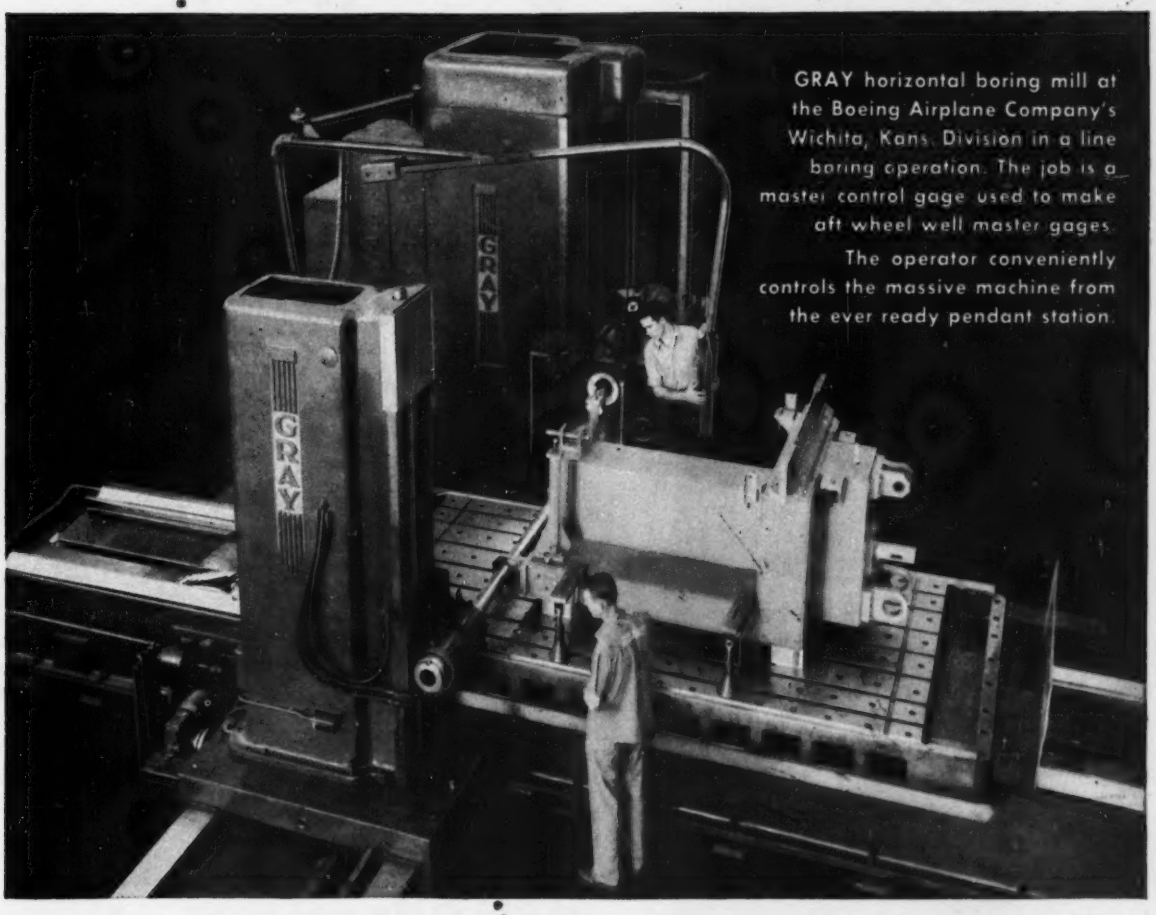
GRAND RAPIDS GRINDERS

... the very best

Manufacturers of
SURFACE GRINDERS • CUTTER and TOOL GRINDERS • TAP and DRILL GRINDERS

BATTING .000 IS TOPS IN THIS LEAGUE

That's why Boeing uses a GRAY 6" BORING MILL. The ultimate in precision is needed to line bore the master control gages that will be used to make master gages for B-47 Stratojet Bombers. Work of this type must be absolutely right—hitting .000" accurately and quickly is imperative—that's why a GRAY was the logical choice. GRAY's high precision, convenience, and modern speed is saving production dollars in hundreds of shops. Whatever your requirements—a GRAY will do the job—better—faster.



GRAY horizontal boring mill at the Boeing Airplane Company's Wichita, Kans. Division in a line boring operation. The job is a master control gage used to make aft wheel well master gages. The operator conveniently controls the massive machine from the ever ready pendant station.

Write today. Get the story on

HIGH
low cost
PRODUCTION

The G.A. **GRAY** *Company*

planers • milling planers
planer type milling machines
horizontal boring machines

CINCINNATI 7, OHIO, U. S. A.
SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. • SOLD IN LATIN AMERICA BY MACHINE AFFILIATES

the 8 sections of your MACHINE TOOL CATALOGS

1 drilling, boring

2 milling

3 turning

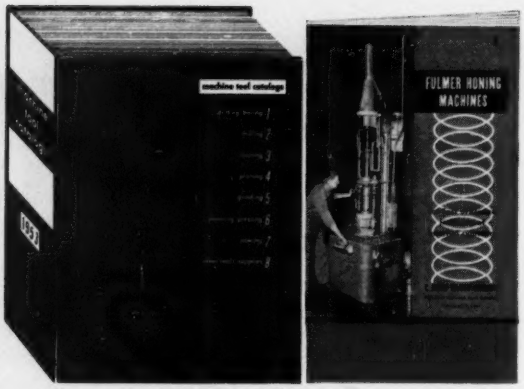
4 planing

5 grinding

6 shearing, pressing

7 sawing

8 other tools, supplies



"...a great time saver"

looking for grinding equipment?

reach for Machine Tool Catalogs

All these manufacturers' catalogs are instantly available in Section 5 of your Machine Tool Catalogs. They contain comprehensive information on a variety of grinders, accessories and auxiliary equipment.

The other sections of the File contain additional catalogs covering a wide range of machine tools and accessories.

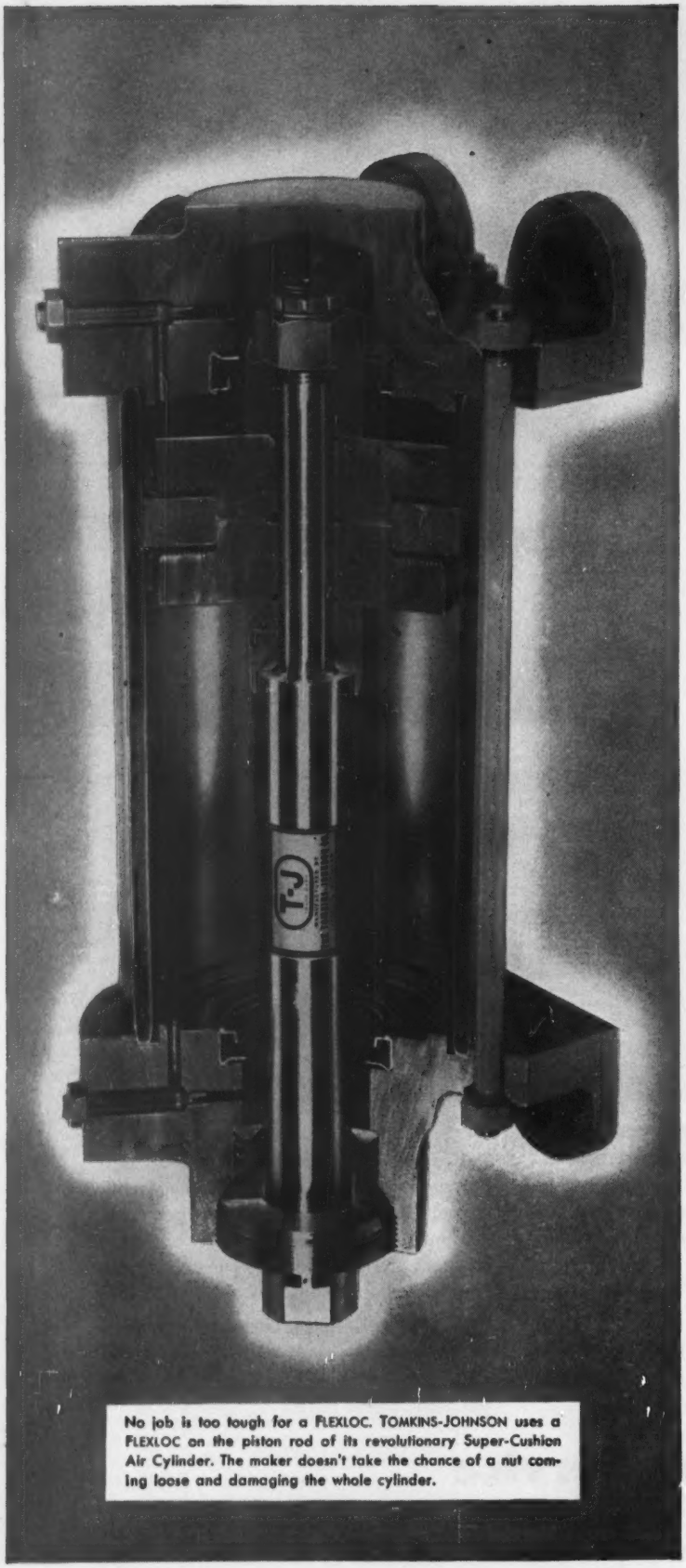
This collection of 82 manufacturers' catalogs is grouped in sections by types of equipment, so that you can more readily compare one machine tool with another. Indexes of manufacturers, products and trade names lead you quickly to the catalogs you are looking for.

Sweet's is working constantly to get more manufacturers to send you their catalogs in this easy-to-use form. If you fail to find what you want, please tell us.

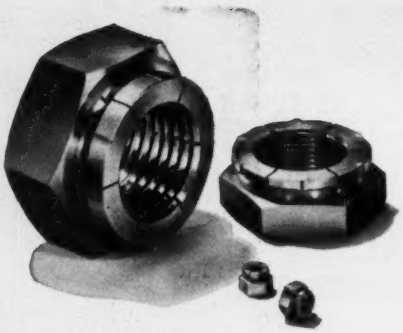
Sweet's Catalog Service

DIVISION OF F. W. DODGE CORPORATION

119 WEST 40TH STREET, NEW YORK 18, N. Y.



No job is too tough for a FLEXLOC. TOMKINS-JOHNSON uses a FLEXLOC on the piston rod of its revolutionary Super-Cushion Air Cylinder. The maker doesn't take the chance of a nut coming loose and damaging the whole cylinder.



What FLEXLOC locknuts do for you

FLEXLOCs eliminate complicated, time-consuming methods of locking threaded fasteners. They offer simpler, faster application and safer, more dependable locking than plain nuts and lockwashers, castellated nuts and cotter pins, or nuts and jam nuts. And they won't work loose.

The reasons for all this are plain. FLEXLOCs are one piece—nothing to assemble, come apart, lose or forget. FLEXLOCs are all metal—have higher tensile than most other locknuts and are not affected by temperatures to 550°F. FLEXLOCs are both stop and locknuts—don't have to seat to lock, and stay put anywhere on a threaded member as soon as their locking threads are fully engaged.

SPS can deliver any quantity of FLEXLOCs in a wide range of sizes. Stocks are carried by industrial distributors everywhere. Write for literature. SPS, Jenkintown 19, Pa.

FLEXLOC®

LOCKNUT DIVISION

SPS

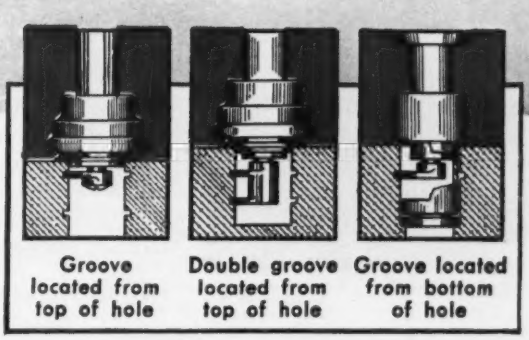
JENKINTOWN PENNSYLVANIA

Our Fiftieth Year : A START FOR THE FUTURE

Waldes Truarc Internal Grooving Tool

for precision cutting of internal grooves in bores and housings

FAST! ECONOMICAL! NEEDS NO SKILLED LABOR!



Groove located from top of hole | Double groove located from top of hole | Groove located from bottom of hole

Internal groove-cutting becomes the simplest of operations with Waldes Truarc Internal Grooving Tool. Easy to adjust—easy to operate...readily adaptable to individual requirements.

Designed for use in any hand drill or automatic drill press and screw machine... assures a concentric recess without injury to metal. Operates by fingertip pressure—especially suitable for unskilled operators.

The Waldes Truarc Grooving Tool when used in an electric or pneumatic hand drill, can be taken to the job eliminating disassembly and excessive handling...resulting in all-around savings in time and costs!

Write now for Catalog giving mechanical details, cutting sizes...extra features...full information

WALDES

TRUARC

REG. U. S. PAT. OFF.

GROOVING TOOL

WALDES KOHINOOR, INC., 47-16 Austel Place, Long Island City 1, N.Y.

Waldes Truarc Grooving Tool
Manufactured under U. S. Pat. 2,411,426

Waldes Kohinoor, Inc., 47-16 Austel Place
Long Island City 1, New York M-015

Please send me complete information on Waldes Truarc Internal Grooving Tool.

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Company_____

Business Address_____

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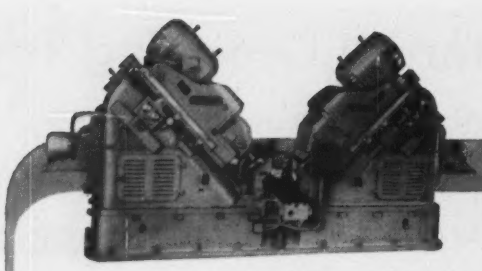
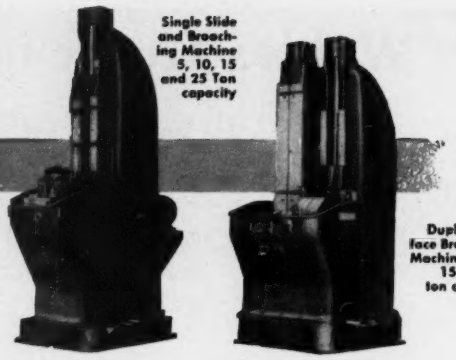


Two-Way Hydraulic Feed Vee Type Stub Boring Machine



Single Slide and Broaching Machine 5, 10, 15 and 25 Ton capacity

Duplex Surface Broaching Machine 5, 10, 15 and 25 ton capacity

FOOTBURT

line of production machines

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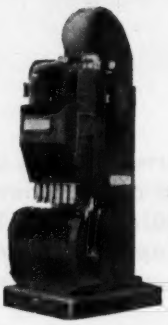
1, 2, 3, 4 and 6 Spindle Sensitive Drilling Machines

● Way Type Drilling, Boring, Reaming, Tapping and Milling Machines with One, Two or More Ways . . . Station Type Machines . . . Center Column Type Machines . . . Cylinder Boring Machines . . . Inverted Drilling Machines . . . Surface Broaching Machines . . . Sensitive Drilling Machines . . . Hammond Radial Drilling Machines . . . Manufacturing Type High Duty Drilling Machines . . . Independent Feed Drilling Machines . . . Special Machines.

Continuous Type Broaching Machine Built in Four Sizes

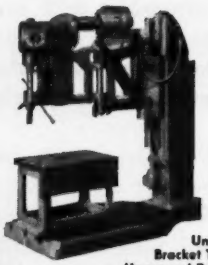


Stub Type Cylinder Boring Machines

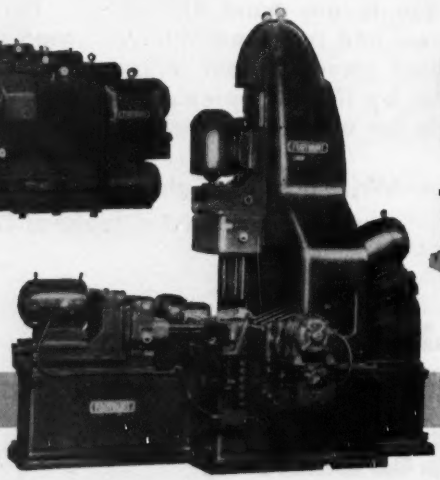
THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

Detroit Office: General Motors Building

17 Station, 104 Spindle, Unit Type, Drilling & Tapping Machine



Unique Bracket Type Hammond Radial Drilling and Tapping Machine



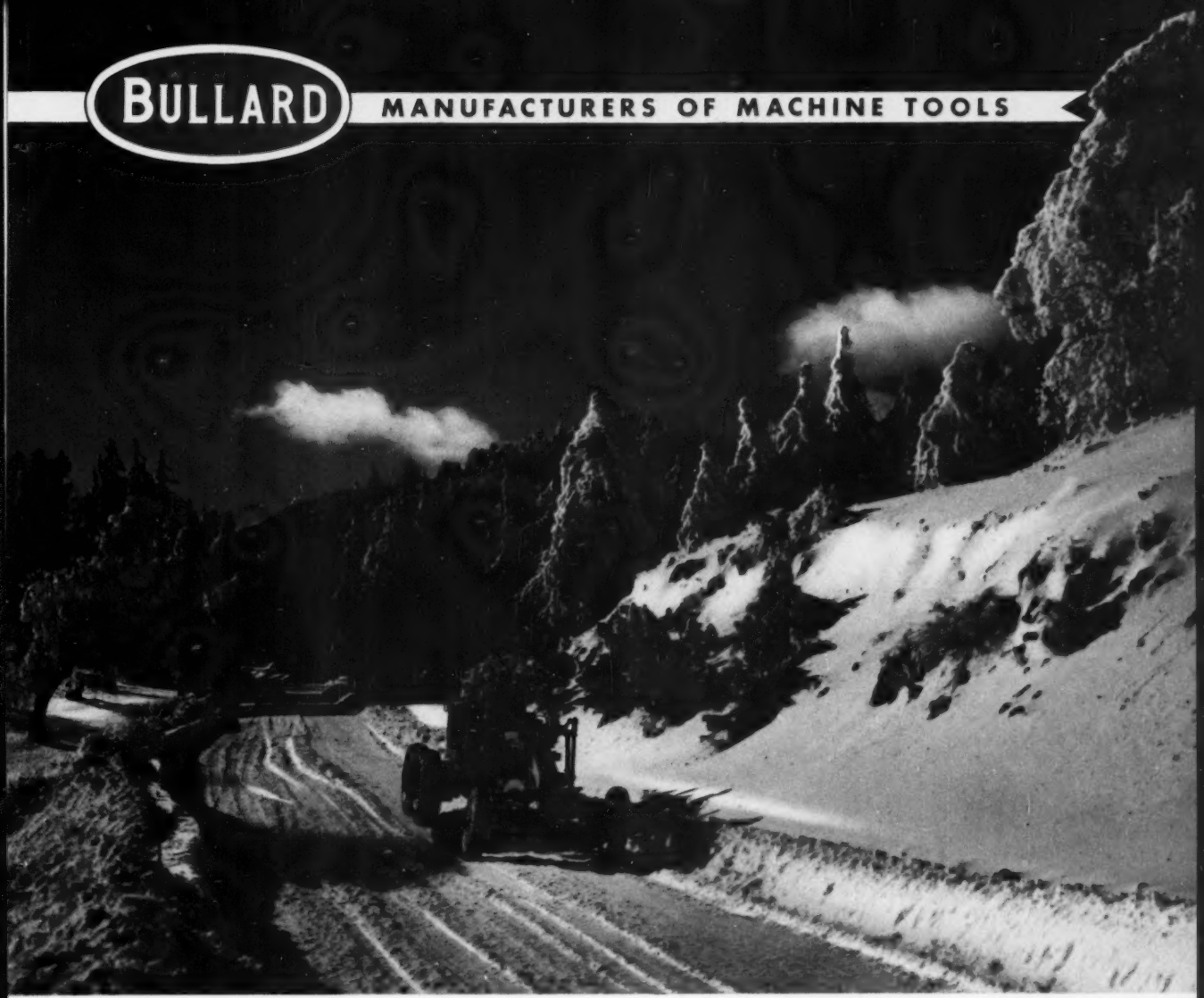
Five Way 21 Spindle Lead Screw Tapping Machine

FOOTBURT

production machine tools

BULLARD

MANUFACTURERS OF MACHINE TOOLS



The Invisible Background of Industrial Progress

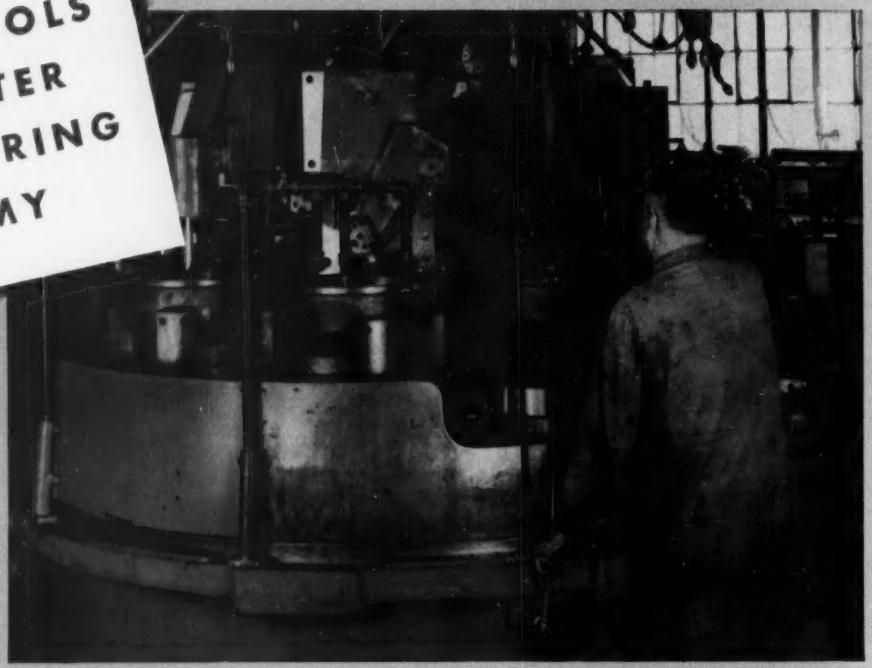
Lake Arrowhead, San Bernardino, California, is a winter sportsmen's paradise. It has been acclaimed the home of the National Orange Show and is famous for its scenic 101-mile drive on the rim of the world. Being accessible by modern, well-maintained roads and transportation facilities its natural beauty and recreational advantages can be enjoyed by more people than ever before. To facilitate year-round travel, Diesel motor graders as shown in the illustration clearing snow from the highway, keep the area open for winter sportsmen.

Many Bullard machines are employed for the manufacture of motorized equipment used for highway construction and maintenance, mechanical operations of orange groves and other agricultural enterprises. . . .
★ *Modern Machine Tools* are the key production machines for all American manufacturing plants. Motor manufacturers in particular have for many years recognized and relied on Bullard machines for their efficient, accurate and dependable production.

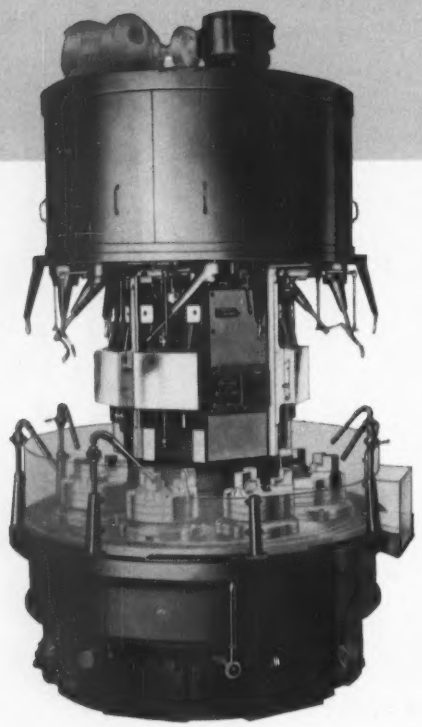
★ *For greater manufacturing economy REFER to next page*

THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT

BULLARD MACHINE TOOLS FOR GREATER MANUFACTURING ECONOMY



A Mult-Au-Matic on production of heavy Brake Drums. Mult-Au-Matic's versatility makes it adaptable to many types of tooling for many different classes of work.



For many years Mult-Au-Matics have been considered versatile production units whether they were on shorter runs or mass production of identical parts.

From its early adoption in the pleasure car manufacturing industry up to the present time in the manufacture of parts for tractors, airplane engines, electric motors and many other classes of work too numerous to mention, the Mult-Au-Matic has set an important economical manufacturing pace for peacetime as well as defense requirements.

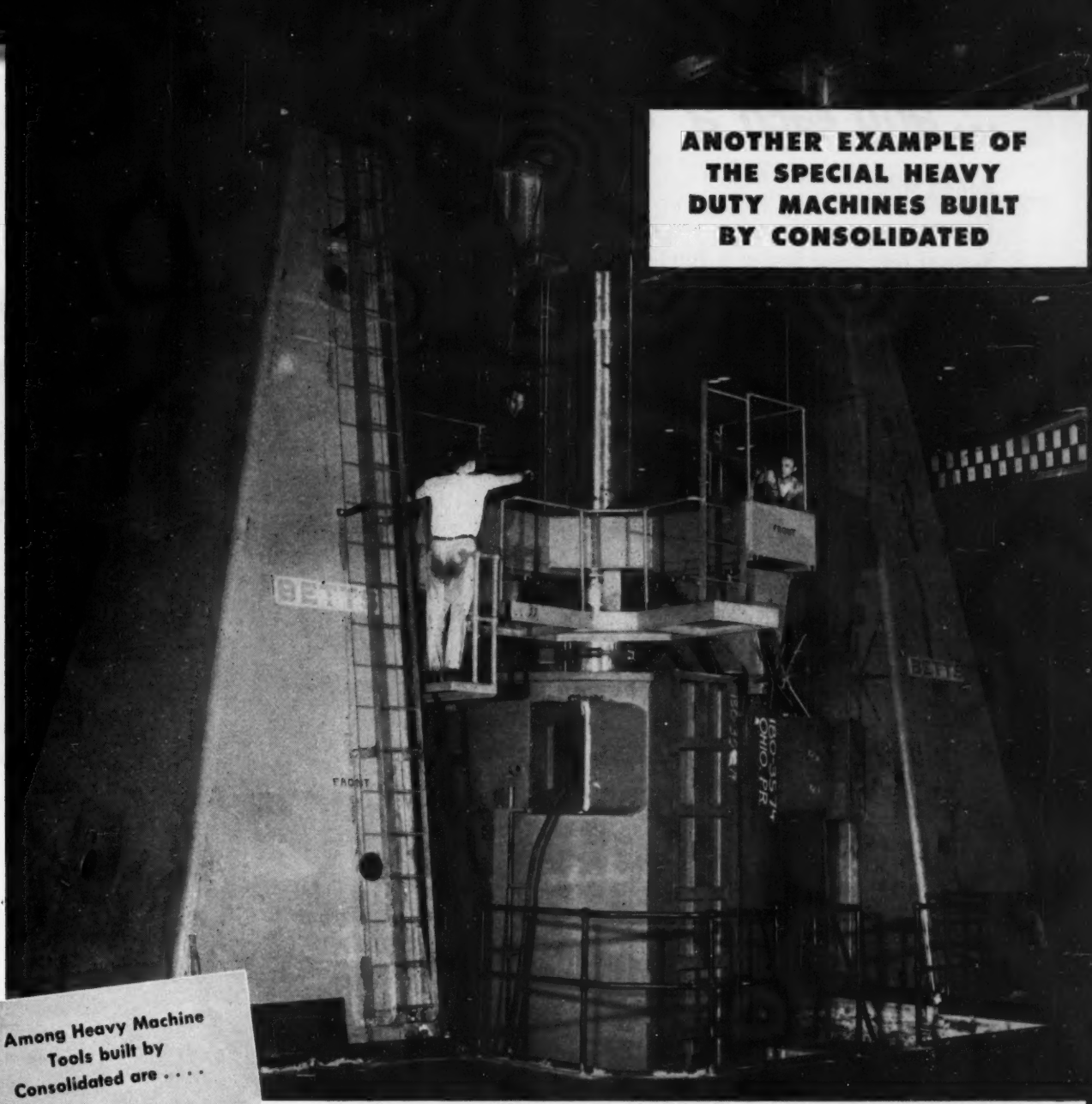
Let Bullard engineers submit surveys on your regular run of work or the more difficult problem jobs.

BULLARD

Time saved is money earned. Write now for information.

THE BULLARD COMPANY BRIDGEPORT 2, CONNECTICUT

ANOTHER EXAMPLE OF THE SPECIAL HEAVY DUTY MACHINES BUILT BY CONSOLIDATED



BETTS SPECIAL VERTICAL BORING AND FACING MACHINE

Built for one of the larger electrical companies and used for boring and facing heavy welded steel generator stator frames from a vertical position, this unusual machine eliminates the inaccuracies heretofore present in such operation performed horizontally and, at the same time, reduces boring time by approximately two-thirds. It may also be used for drilling rib sections and milling spring assemblies. This machine is 36'-6" high, 13'-0" of which is below the floor level. Weight approximately 190,000 pounds. The boring bar is 22" in diameter and 36'-0" long.

Among Heavy Machine Tools built by Consolidated are . . . .

- LATHES
- BORING MILLS
- DRILL PRESSES
- MILLING MACHINES
- BORING MACHINES
- COLD SAW MACHINES
- BORING, DRILLING AND MILLING MACHINES
- DRILL AND TOOL GRINDERS
- PLANERS
- SLOTTERS
- RAILROAD SHOP TOOLS
- AUTOMOTIVE TOOLS
- AND OTHER SPECIAL MACHINES

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED
MACHINE TOOL CORPORATION

SUBSIDIARY OF FARREL-BIRMINGHAM COMPANY, INCORPORATED

ROCHESTER, NEW YORK

... and each a "blue-chip" product

Boring Mills
Planers
Vertical Side-Head Boring & Turning Mills
Axle Burnishing Lathes
Hydraulic Centering Machines
Car Wheel Lathes
End-drive Axle Lathes
Diesel Wheel Borers
Plate Planers
Horizontal Mills
Engine Lathes

HOW NILES ENGINEERING

helps output take a turn for the better

Engineering machine-tool giants that can hog out ¾-inch chips . . . then finish cut to ten-thousandths . . . is our business here at Niles. And after a century of such specialization, we *know* how to engineer the big tools to give you big output.

How big a machine tool do you need? We've built many of the largest ever made . . . lathes with 10-foot swing . . . planers with a 15-foot clearance between housings . . . boring mills with 43-foot swing.

Do you need extra power? All Niles tools are designed with extra rigidity and more power . . . designed to shrug off the stresses of deep cuts and modern feeds and speeds with carbide tipped tools.

Do you need precision plus? We make Niles tools heavier and more powerful, but we also build them to the highest precision standards . . . build them to give you consistent, close, sustained accuracy. That's the reason they're top favorites with the close tolerance manufacturers of precision instruments, ball bearings, tools, dies, and other machine tools.

So why not check Niles when you tool-up. Niles is one of the *great* names in machine tools . . . and the payoff to you is in a *greater* output with *greater* accuracy, over a *greater* number of years.

Why not write *today* for Catalog 91551.

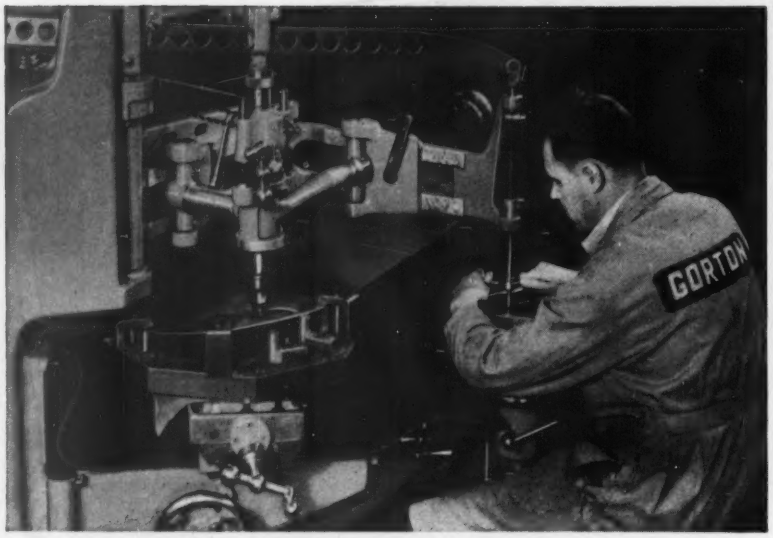
Write to

LIMA-HAMILTON DIVISION

Hamilton, Ohio

BALDWIN-LIMA-HAMILTON

Philadelphia 42, Pa. • Offices in Principal Cities



Tracer-Controlled Pantograph cuts and rounds thermal slot in 8-foot steel propeller blade in 40 minutes; previous time was 5 hours, 10 minutes — just one of hundreds of examples of time and cost saving with tracer-controlled Pantograph machines.

Pantography IS NEW —

By George Gorton III
Executive Vice President,
George Gorton Machine Co.

— in the sense that industry at large and Metal Working people in particular are just beginning to appreciate the many advantages Pantography offers to those faced with the Design-Production problems of today and tomorrow.

INDUSTRY'S foremost responsibility right now is to produce faster, to highest quality standards and at lower cost — whether on defense contracts or for our civilian needs.

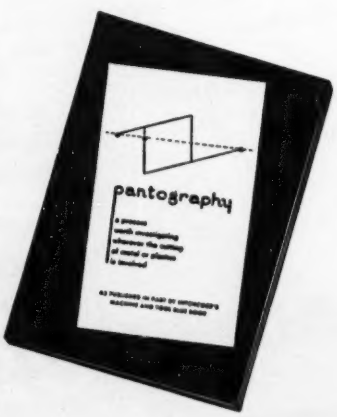
Today, there are literally thousands of operations being performed throughout industry which can be speeded up, improved in quality and lowered in cost by the use of available models of special machine tools. The modern tracer-controlled Pantograph machine is such a tool. It is both a special purpose machine, ideal for short runs, and it is an accurate single purpose machine which turns out identical parts or pieces to meet tight production schedules.

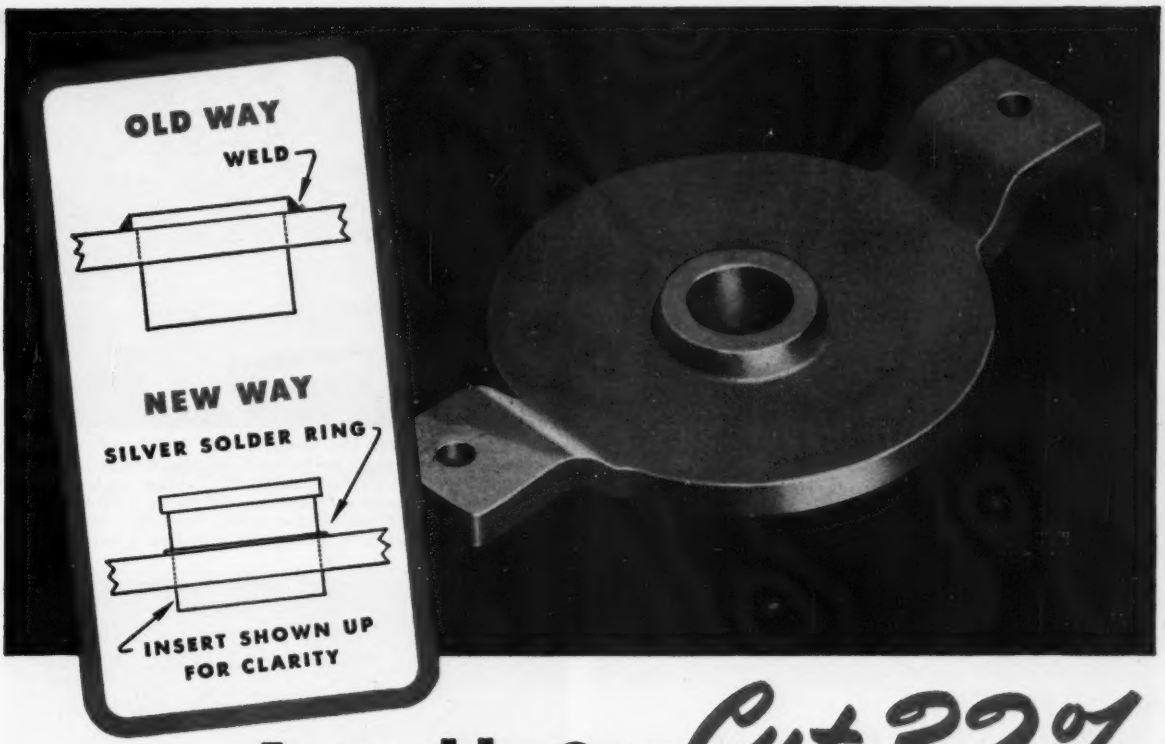
The tracer-controlled Pantograph machine is used for inside and outside profiling, routing, die sinking, mold cutting, counterboring, contour milling, chamfering, grooving, graduating and engraving in ferrous and non-ferrous metals, as well as in plastics.

This machine performs on flat, uniformly curved, cylindrical, spherical or irregular shapes — it works in either 2 or 3 dimensions, in all directions on a horizontal plane, and vertically. It employs enlarged masters, templates or patterns which are quickly and easily made and operates normally at a reduction ratio thereby increasing accuracy — exclusively characteristic of the pantograph.

Single or repetitive accuracy — from one piece to thousands — manual or full automatic operation depending upon quantities — work sizes from the size of a dime to as large as 10 feet.

A new booklet, "Pantography," explains the process and shows what this type of machine can do for you. It is yours without obligation. Write for it today. If interested, also ask for our latest General Catalog 1655. Address the George Gorton Machine Co., 1301 Racine Street, Racine, Wisconsin, U. S. A.





Assembly Cost *Cut 32%* with TOCCO* Induction Brazing

Now's the time to balance YOUR production budget

This assembly may bear no resemblance to your product, but its case is typical of the savings accomplished by Induction Heating of metal parts of all sizes and shapes.

Formerly the Norris Thermador Corporation used arc welding to join the bushing and clamp shown above. In an effort to reduce costs TOCCO Induction Heating was brought into the production picture with the following results:

OLD METHOD (Arc Welding)		**NEW METHOD** (TOCCO Induction Brazing)	
Material (rod)	$ 4.56 per M parts	Material (solder and flux)	$13.83 per M parts
Labor	20.63 per M parts	Labor	8.82 per M parts
Overhead	21.25 per M parts	Overhead	9.08 per M parts
Total Cost Old Method	$46.44 per M parts	Total Cost TOCCO Method	$31.73 per M parts

TOCCO Engineers are glad to survey your operations for similar cost-cutting results — no obligation, of course.

THE OHIO CRANKSHAFT COMPANY

TOCCO

Mail Coupon Today

NEW **FREE** BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. M-1, Cleveland 1, Ohio

Please send copy of "Typical Results of TOCCO Induction Brazing and Soldering."

Name_____

Position_____

Company_____

Address_____

City_____ Zone____ State_____

In grinding . . .

you get the most from Norton

because Norton has the most to offer you

Only Norton offers you such long experience in both grinding wheels and machines to help you produce more at lower costs.

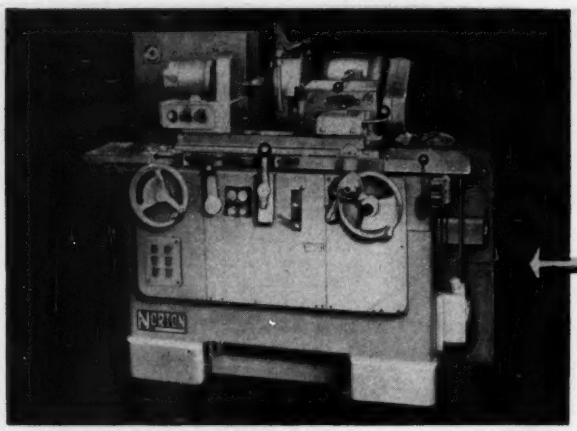
Take advantage of this experience. Discuss with us your present grinding problems or your post-emergency production to fit tentative delivery schedules into your future plans.

***To Economize Modernize With* NEW**

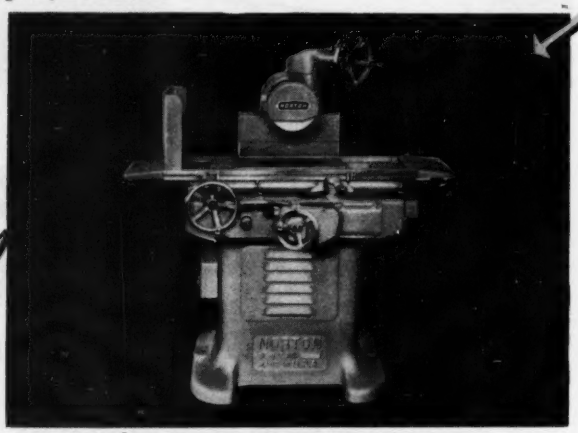
NORTON

GRINDERS *and* LAPPERS

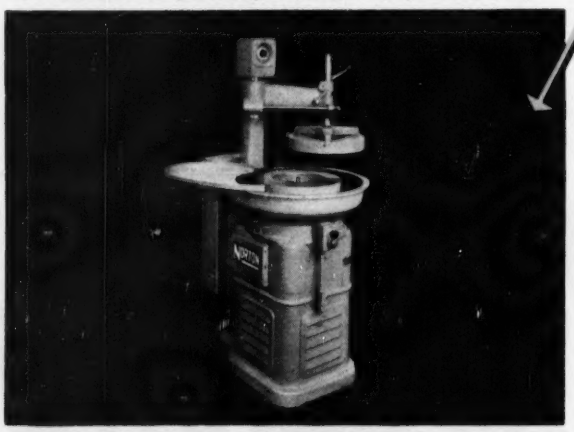
Making better products to make other products better



NEW NORTON 4" TYPE CTU Semiautomatic, in 12" and 18" work-length capacities, rounds out the Norton Cylindrical Grinder Line. Like the larger 6" and 10" CTU's, it offers you a unique combination of speed, accuracy, flexibility and sturdiness. All Norton CTU Semiautomatics have "one lever" control of automatic time cycle which reduces operator attention merely to loading and unloading. *Catalog No. 531* gives you all details.



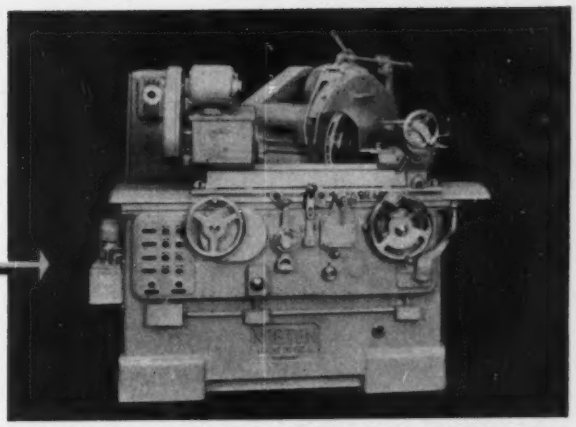
NORTON HYDRAULIC SURFACE GRINDERS, designed with both hand and hydraulic table traverse and cross feed, produce plane surfaces smoothly and speedily. Convenient controls and easy accessibility keep operating and maintenance time low. Such extras as a permanent magnet or direct current type chuck, wet grinding attachment or individual dust exhaust system help make a good basic machine better. Three sizes: 6", 8", and 10". *Write for Catalogs 954 (6"); 190 (8") and 1745 (10").*



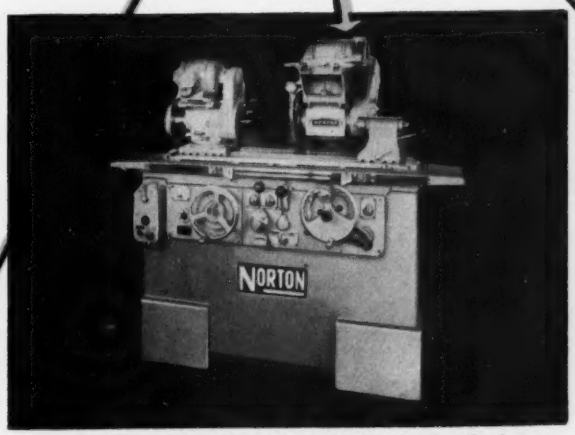
NORTON TYPE 16FC VERTICAL LAPPER produces either flat or cylindrical work to a high degree of dimensional accuracy, parallelism and finish. Widely used for such work as diesel injector parts, plug gages, size blocks, sides of small bearing races, pump gears and plates and other parts. Other Norton lappers are available. *Write for Catalog 212 and General Catalog 1843.*

Norton Grinders and Lappers

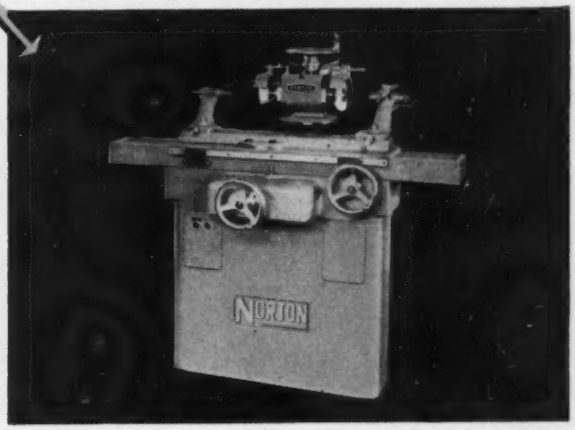
The world's most complete line



NORTON ANGULAR WHEELSLIDE GRINDERS are semiautomatic machines which simultaneously grind thrust surfaces and adjacent diameters to finest accuracy and finish. By eliminating the need for an extra operation, they cut over-all production costs. "One lever" control of automatic time cycle, as in CTU's, helps operators produce more with less effort. Two sizes: 6"x18" and 10"x36". *Catalogs No. 533 (6"x18") and 1793 (10"x36")* give you more information.



NORTON UNIVERSAL GRINDERS are so flexible they handle almost an endless variety of jobs. Compound swivel arrangement allows you to set and feed the wheel at any angle. External, internal, face or angular wheelslide operations come easy with Norton Universal Grinders. Four sizes: 10"x20" and 12", 14", or 16", each with work length capacities of 36", 48", or 72". *Write for Catalogs 170 (10"x20") and 1668 (12", 14", 16").*



NORTON NO. 20 CUTTER AND TOOL GRINDER, with its tilting wheel head, is the most versatile machine in its class. Wheel head tilts 15° above or below horizontal . . . may be swivelled 360° in a horizontal plane. Integral motor cartridge type spindle, duplicate controls for front or either-side operation are other features that make this machine first choice for toolroom grinding. *Write for Catalog 189.*

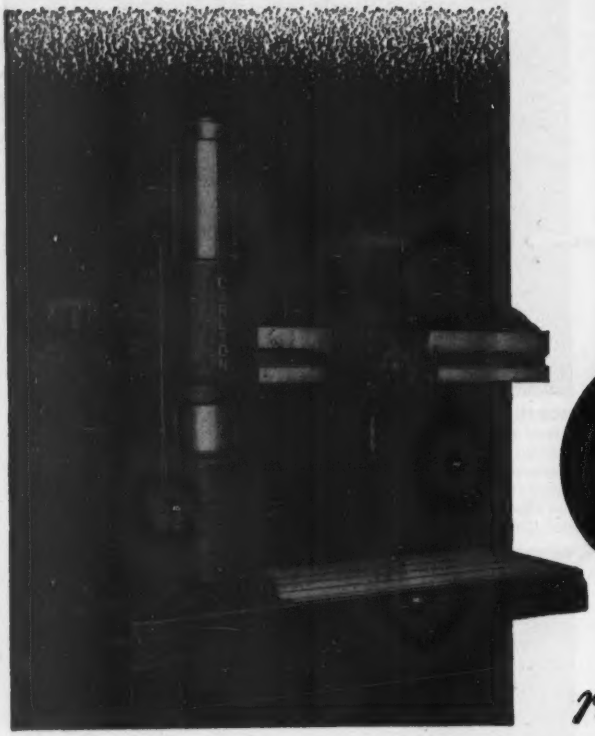
ONLY NORTON OFFERS YOU OVER 50 YEARS OF COMBINED EXPERIENCE IN:

Abrasives and Grinding Wheels + **Machines for** Cylindrical Grinding • Surface Grinding • Cylindrical and Flat Lapping • Universal Tool and Cutter Grinding • Universal Multipurpose Grinding • Specialized Grinding • Crankshaft Grinding • Cam Shaft and Contour Grinding • Roll Grinding.

NORTON COMPANY • MACHINE DIVISION • WORCESTER 6, MASS.

District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit

In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5



count on

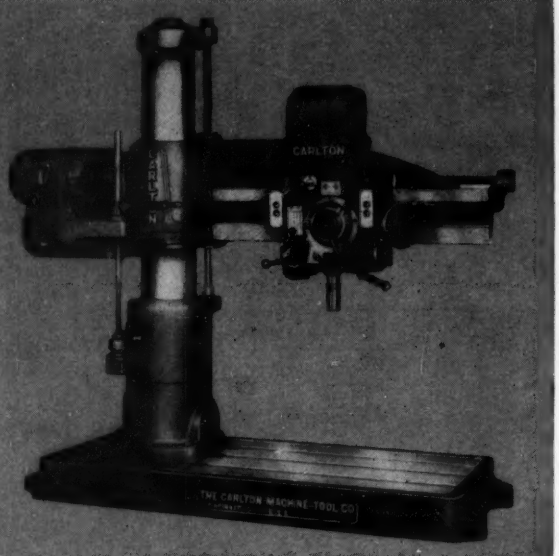
Carlton

for all your radial drill requirements

In the broad Carlton line there's a radial that will drill and tap any holes you may have from ¼" to 10" diameter. Between the 5A with 26" column and 12' arm . . . and the 1A with 9" column and 3' arm . . . there are five basic models and many different column and arm sizes. With this variety you can buy exactly the right size Carlton for your requirements.

And with the numerous types of bases and tables available with Carlton Radials, you'll have all the hole production facilities you've always wanted.

Add to this the many Carlton design and construction advantages . . . and you'll find you can count on Carlton for capacity, production flexibility and performance. Why not send today for full particulars?



THE CARLTON MACHINE TOOL CO., CINCINNATI 25, OHIO, U.S.A.

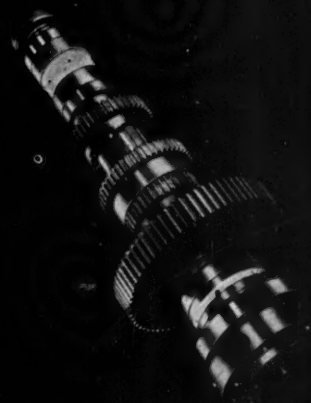
Gentlemen: Please send me bulletin(s) checked below:

NAME_____

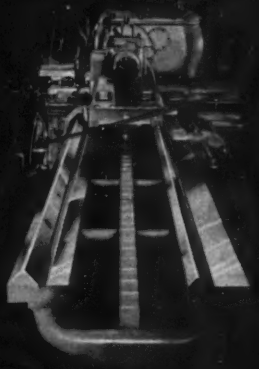
ADDRESS_____

CITY_____ STATE_____

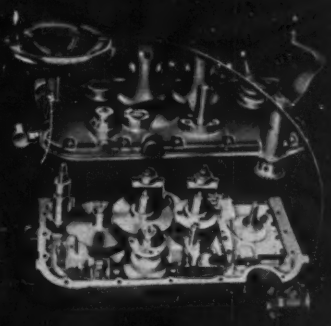
- ☐ 1A— 9" col. 3'–4' arms; 11" col. 3'–4'–5' arms
- ☐ 3A— 13" col. 4'–5' arms; 15" col. 4'–5'–6' arms; 17" col. 5'–6'–7' arms
- ☐ 4A— 19" col. 6'–7'–8' arms
- ☐ 5A— 22" col. 7' to 10' arms; 26" col. 8' to 12' arms



MASSIVE - RIGID

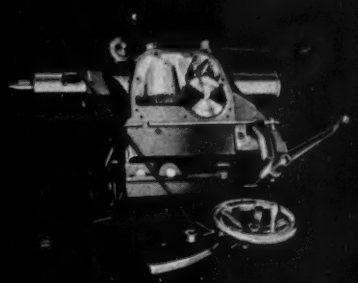


HARDENED STEEL - PRECISION GROUND



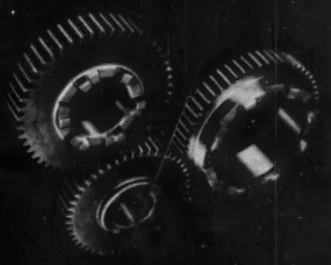
PROTECTED FOR LIFE

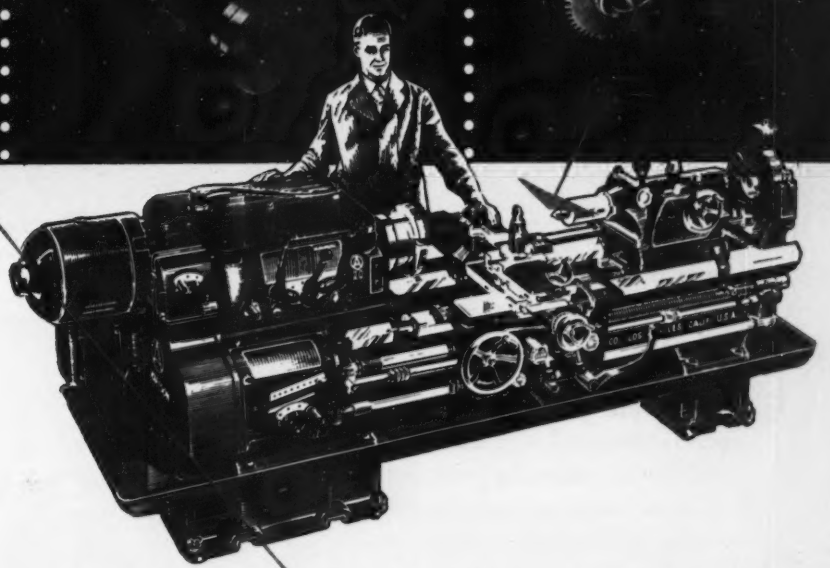
TWO SPEED TAILSTOCK



AS FRICTION FREE AS HUMANLY POSSIBLE

QUIET - SMOOTH - TOUGH





AXELSON LATHES . . . *Chosen first to last!* Axelson engine lathes are accurate — there isn't a more accurate lathe on the market — they are dependable, they have stability — they keep their precision under continuous, heavy service — they are recognized internationally as the quality tool by men demanding the utmost in metal working equipment. ■ *Axelson manufactures heavy duty engine lathes in 16", 20", 25", and 32" sizes of various lengths; precision tool room lathes; a 20" medium duty engine lathe; gap lathes.*

Chosen first....to last! 65th YEAR

AXELSON Lathes

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

TOOL ROOM LATHES • GAP BED LATHES • HEAVY DUTY ENGINE LATHES

AXELSON MANUFACTURING COMPANY, Division of Pressed Steel Car Company, Inc. • LOS ANGELES 58 • NEW YORK 7 • ST. LOUIS 16

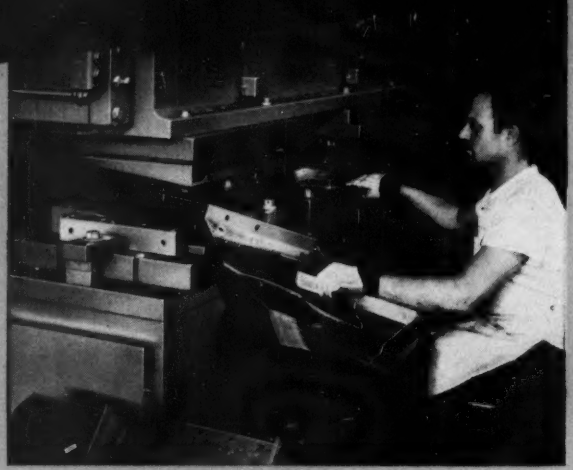
Authorized Distributors in All Principal Industrial Centers

NIAGARA

SERIES B

GAP FRAME Double Crank Presses

Niagara B-4 x 72 Press at the General Machine Works in Los Angeles. It is shown here fitted with two dies for forming operations on an automatic deflector.



The same press as shown above arranged with dies for redrawing projectile parts in 5 steps. Shells are transferred manually from die to die.

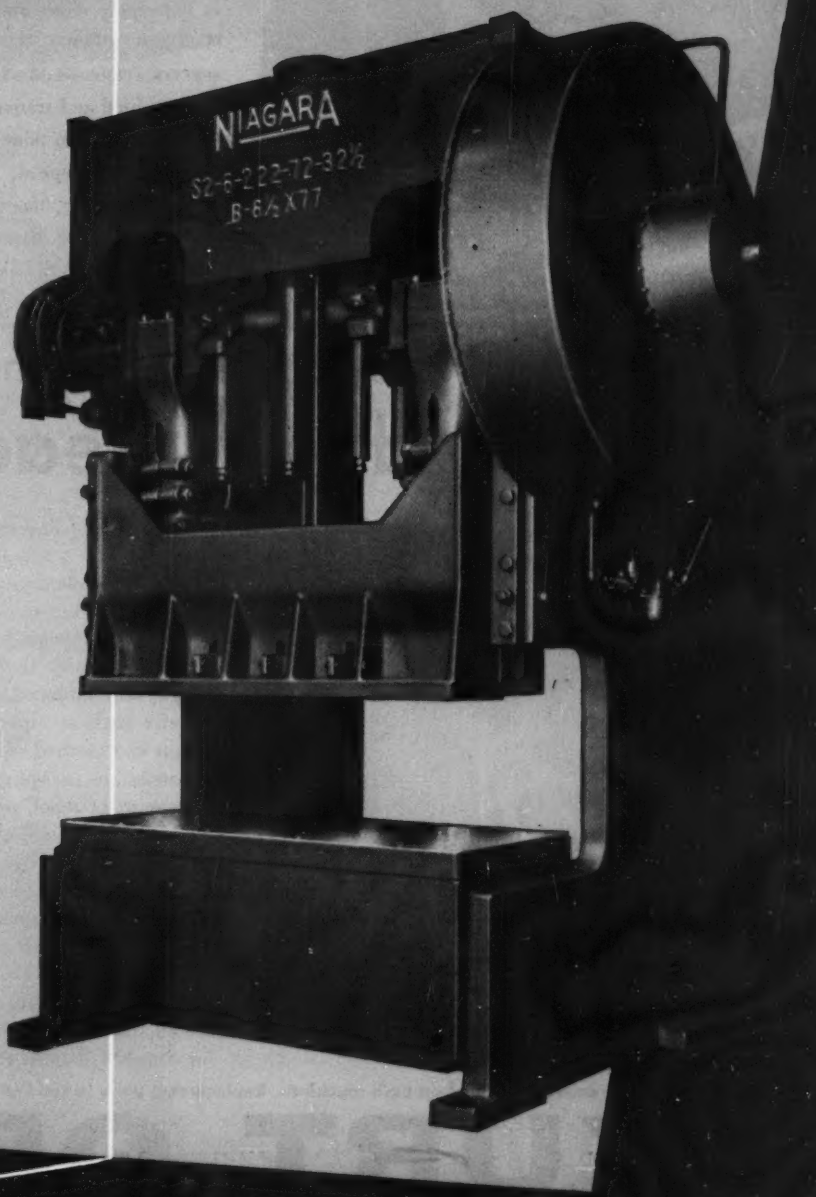
NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

Manufacturers of a complete line of sheet metal working equipment ranging from small hand tools up to large power operated machinery.

Versatility and High Production

- Gap frame convenience with double crank width.
- Ideal for long progressive dies or multi-station dies.
- Rear of press open for full accessibility.
- One piece welded steel frame for maximum rigidity and long die life.
- Exclusive Niagara Sleeve Clutches for maximum productive strokes per minute and minimum maintenance cost.
- Niagara cushions for drawing operations.
- Automatic feeds for high production jobs.

Write for Bulletin

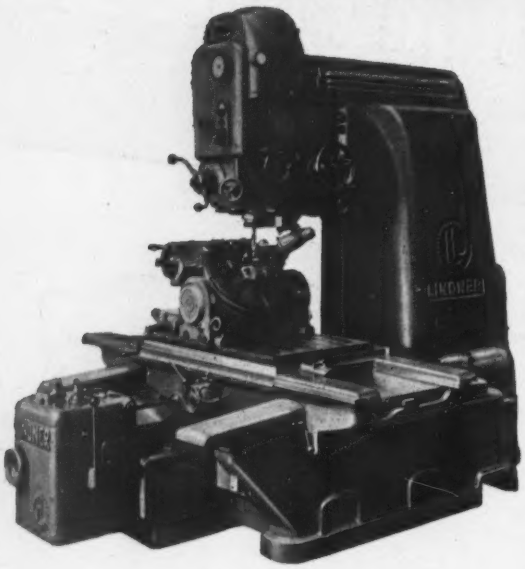


Niagara B-6½ x 77 Gap Frame Double Crank Press. Air actuated, electrically controlled sleeve clutch with friction clutch convenience and sleeve clutch economy. Air releasing brake. Clutch and gearing operating in a bath of oil. Air counterbalance for slide with surge tank over-size cylinder and pressure regulating valve to compensate for various weights of dies. Cross bar knockout in slide. V-belt motor drive.

DISTRICT OFFICES: NEW YORK • CLEVELAND • DETROIT • PHILADELPHIA

Direct-reading optical measuring system in

Lindner Jig Borer guarantees—



Accurate table settings to .000157"
Accurate readings in .00004"
Accurate adjustment permanently maintained
Measuring system free of mechanical wear

Such jig boring accuracy speaks for itself—and explains why a growing number of important toolrooms, who measure precision in extremely close limits, "like the Lindner better". May we send you complete details?

SPECIFICATIONS—LINDNER NO. 15 JIG BORER (Illustrated)
Longitudinal and transverse table movements 40" x 24".
Distance between table and boring spindle 10"–30", 34", 38".
Boring spindle speeds infinitely variable from 50–1900 RPM.
Maximum boring diameter from the solid $1\frac{19}{32}$".
Maximum boring diameter 10"; diameter of milling cutter 5".
Also available: No. 14 with 24" x 16" table movements.

Lead and pitch tolerances held within .00008" in

Lindner Thread Grinders

Lindner Standard Type Grinding Machine with center distance of $31\frac{1}{2}$" and maximum thread length of $19\frac{11}{16}$".

Lindner, who pioneered the first thread grinder ever built, is first again with a new and unique design, which produces exceptionally close-tolerance traverse and plunge grinding. Here's why:

Entire worktable, which carries headstock and tailstock, can be tilted by a single lever into position at the grinding wheel. Lever also starts the completely automatic cycle. Tableway design, with hardened and ground lead screw, eliminates all play.

Helix angle is adjusted by swiveling worktable by means of pinion and toothed segment. Workpiece headstock contains all transmissions for spindle drive and table feed.

Amount of relief, number of flutes, lead, and correction for the lead, when grinding hobs, as well as the ratio between thread-lead and flute-lead, can be set independent of each other without calculations, simply by reading tables on the grinder bed. This can be done by inexperienced men in a few minutes even if only the workpiece drawing contains this information.

Lindner Thread Grinders are already on-the-job in leading plants. Others are on-the-way to companies who were quick to see all the Lindner advantages. You will, too, when you write for complete details.

Early delivery assured on both machines. Replacement parts in stock at our Cleveland Service Center.

KO CO. INC. INDUSTRIAL IMPORTERS

KURT ORBAN

COMPANY, INC.

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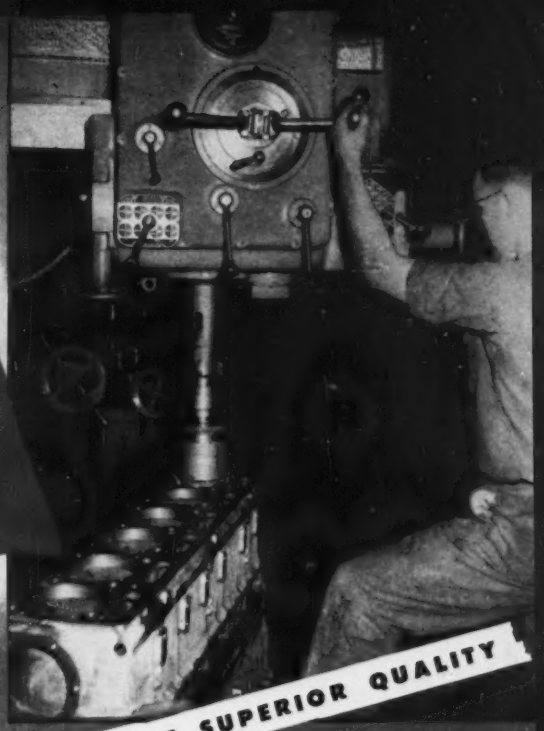
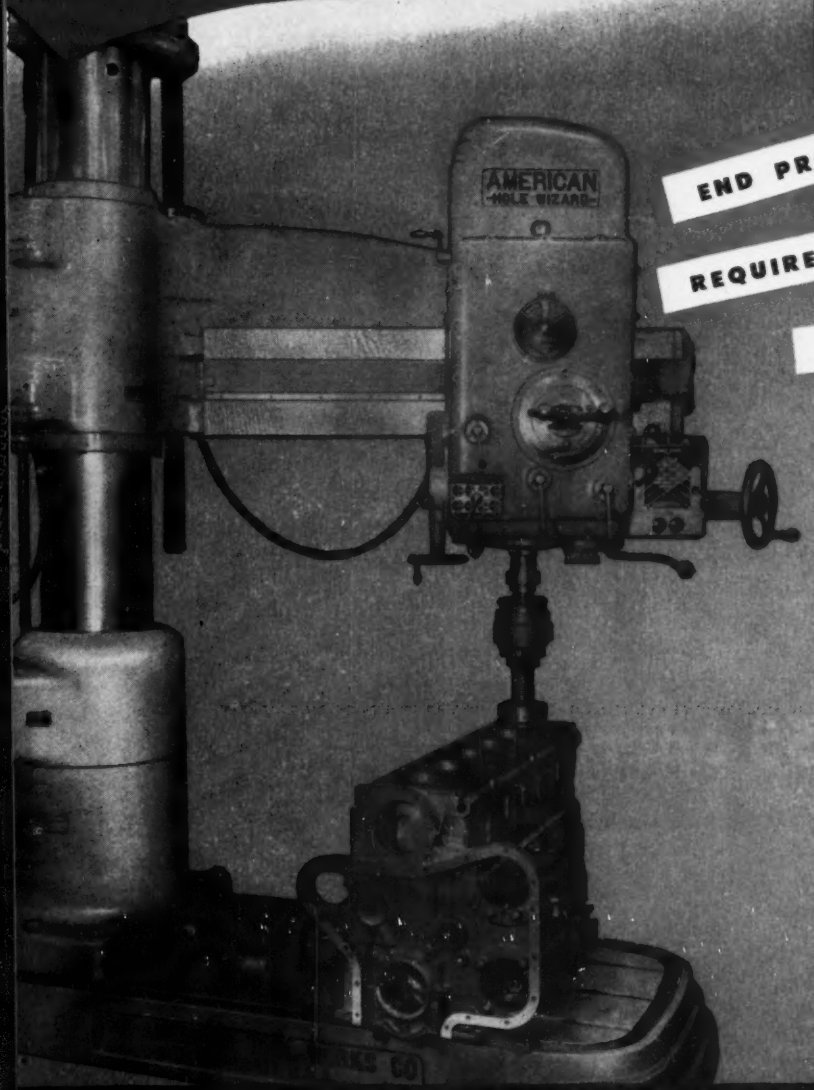
The 2 are inseparable—





END PRODUCTS OF SUPERIOR QUALITY

REQUIRE SUPER QUALITY EQUIPMENT

TO PRODUCE THEM . . .

For six years this "AMERICAN" Hole Wizard Radial has been counterboring "Cummins" Diesel Engine Blocks and holding the required depth tolerance of .001" in the 6.125" counterbores. Furthermore, the operator testifies to the fact that the machine is convenient and easy to operate and maintenance has been negligible.

The quality of "Cummins" products is universally recognized. We are proud indeed that so many "AMERICAN" Lathes and Radial Drills contribute to it.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

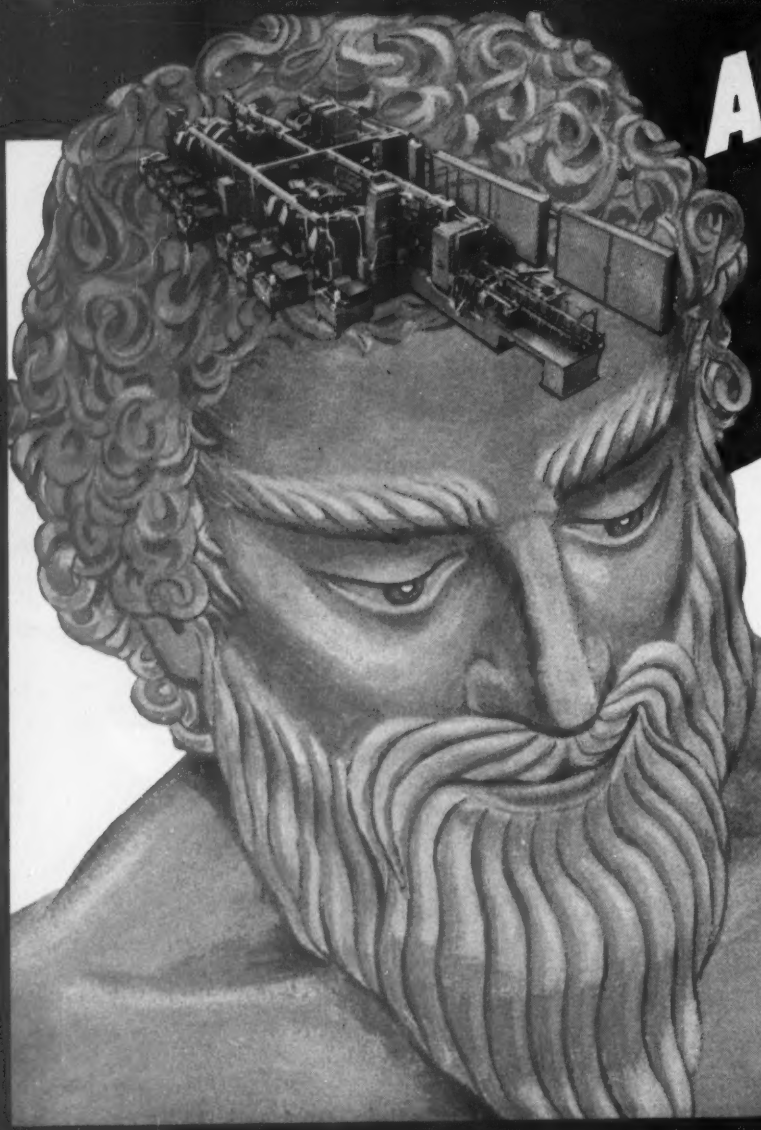
LATHES AND RADIAL DRILLS

See how another

AUTOMATIC HOLEWAY GIANT

NATCO

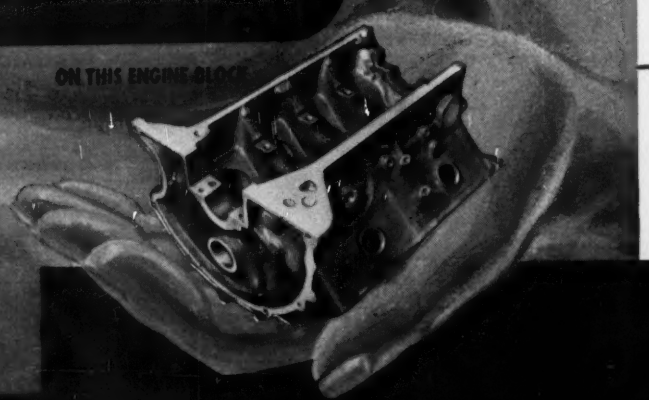
NATCO ENGINEERED
for quality and quantity production



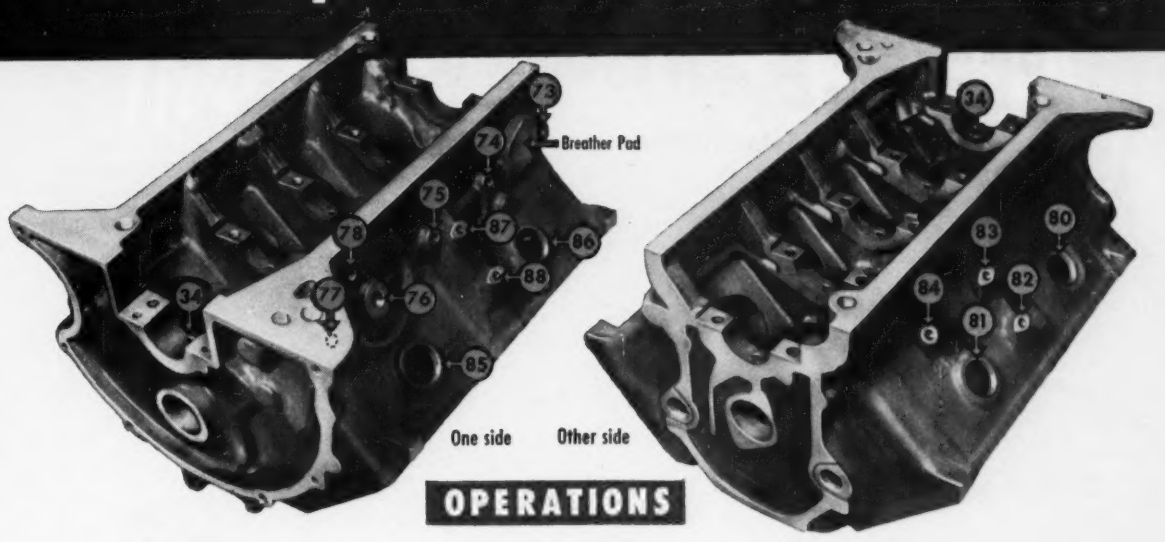
Completes all 55 operations

at the rate of nearly 2 parts per minute

including milling, drilling, combination core drilling and chamfering, reaming, combination spot facing and chamfering, combination rough counterboring and spot facing, rotating part 180° vibrating for chip removal, and *Inspecting Holes.*



PRODUCES 111 PARTS PER HOUR
and inspects its own production



OPERATIONS

STATION #1 Load 1 part

STATION #2

Right Angular Head (17° above horizontal)
- Drill 1 hole #74 to 7/16" diameter part depth.
- Drill 3 holes #73, #75 and #77 to 7/16" diameter part depth.
- Drill 1 hole #76 to 31/32" diameter part depth.

STATION #3

Right Angular Head (17° above horizontal)
- Drill 1 hole #74 to 7/16" diameter additional part depth.
- Drill 3 holes #73, #75 and #77 to 7/16" additional part depth.
- Drill 1 hole #76 to 7/16" diameter additional part depth.

STATION #4 Idle

STATION #5

Left Angular Head (45° above horizontal)
- Combination core drill and chamfer 2 holes #80 and #81 1-23/32" dia. for 1.750" ream.
- Drill 2 holes #82 and #83 to 3/8" diameter for 7/16" x 14 tap.
- Drill 1 hole #84 to 7/16" dia. through for 1/4 NPSF Thread.

Right Angular Head (45° above horizontal)
- Combination core drill and chamfer 2 holes #85 and #86 to 1-23/32" dia. for 1.750" ream.
- Drill 2 holes #87 and #88 to 3/8" diameter for 7/16" x 14 tap.

STATION #6

Left Angular Head (45° above horizontal)
- Ream 2 holes #80 and #81 to 1.750" diameter. Combination spot face and chamfer 2 holes #82 and #83 to size.

Right Angular Head (45° above horizontal)
- Ream 2 holes #85 and #86 to 1.750" diameter. Combination spot face and chamfer 2 holes #87 and #88 to size.

STATION #7 Idle

STATION #8

Left Angular Head (angle off vertical)
- Drill 1 hole #34 to 1/4" diameter 1/2 depth.

Right Angular Head (17° above horizontal)
- Combination rough counterbore for 4.94" finish diameter and spot face 1-15/16" dia. bolt boss #76.

STATION #9

Left Angular Head (angle off vertical)
- Drill 1 hole #34 to 1/4" diameter through.

Right Angular Head (17° above horizontal)
- Finish counterbore 1 hole #76 to 4.94" diameter.

STATION #10 Idle

STATION #11

Right Angular Head (17° above horizontal)
- Drill 4 holes #73, #74, #75 and #77 to 11/32" diameter additional part depth.
- Drill 1 hole #76 to 11/32" diameter additional part depth.
- Drill 1 hole #78 to 11/16" diameter .24" deep.

STATION #12

Right Angular Head (17° above horizontal)
- Drill 4 holes #73, #74, #75 and #77 to 11/32" diameter additional part depth.
- Drill 1 hole #76 to 11/32" diameter additional part depth.
- Drill 1 hole #78 to 9/16" diameter .46" depth.

STATION #13 Idle

STATION #14

Right Angular Head (17° above horizontal)
- Drill 4 holes #73, #74, #75 and #77 to 11/32" diameter to depth.
- Drill 1 hole #76 to 11/32" diameter to depth.

STATION #15

Right Vertical Head
- Mill 4" dia. seat around hole for oil breather tube.

STATION #16 Idle

STATION #17
- Rotate part 180°, vibrate while rotating from pan face up to pan face down front end leading.

STATION #18

Left Side (17° below horizontal).
- Inspect holes to be tapped for drill through and depth 5 holes #73 to #77 incl. (45° below horizontal).
- Inspect holes to be tapped for drill through and depth—2 holes #87 and #88.

Right Side (45° below horizontal)
- Inspect holes to be tapped for drill through and depth 3 holes #82, #83 and #84.

STATION #19 Unload
- Oil pan face down front end leading.

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to help you solve your problems in Drilling, Boring, Facing and Tapping.

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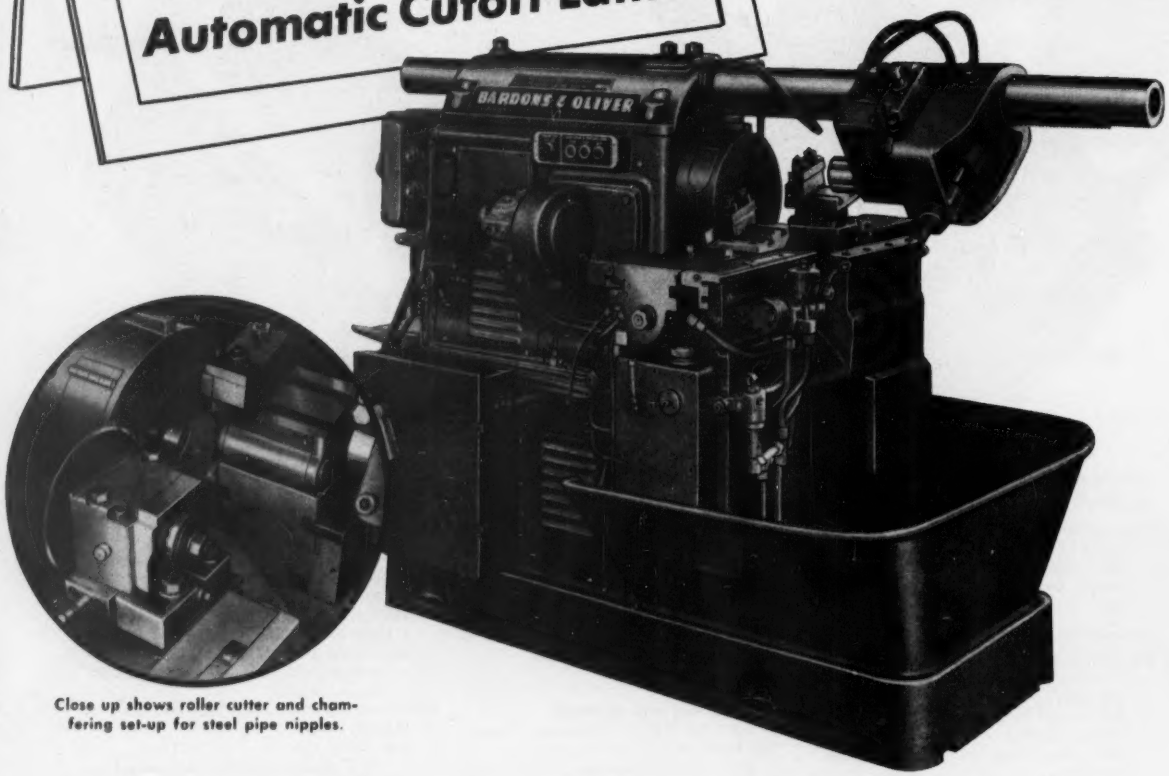
Presenting a NEW BARDONS & OLIVER Automatic Cutoff Lathe

No. 33—WITH CAPACITY TO 3" DIA. (2½" PIPE)

No. 34—WITH CAPACITY TO 4" DIA. (3½" PIPE)



Close up shows roller cutter and chamfering set-up for steel pipe nipples.

Average production on steel pipe nipple blanks up to 6" long, cutoff with roller cutter and chamfered on both ends on O. D., ready for threading.								
Pipe Size	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"
Pcs. per min.	43	36	28	22	18	15	12	9

Production estimates for lengths over 6" quoted on request. Correspondingly high rates of production can be obtained when cutting off other types of tubing or pipe.

The NEW BARDONS & OLIVER No. 33 and No. 34 cutoff lathe is designed for greater productivity. Either square cut ends or roller cut ends are readily obtained with a higher rate of production. Electric remote control permits automatic cutoff to any length. Spindle speeds range from 85 to 1100 RPM with four quick changes. In addition, a pair of reversible pick-off gears makes available a total of eight speed changes. Multiple cuts can be taken with the wide, heavy cutoff slides. Independent hydraulic systems are used for the cutoff slides and collet chuck operations. Since no cams are used, a complete change in set-up from one size and length of work to another can be made in less than one-half hour.

A newly designed Stock Feed Table, which operates automatically is now available for this new Automatic Cutoff Lathe.

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TAPS
THREADWELL TAP & DIE CO. Greenfield, Mass., U. S. A.

Tap Recommendations for Various Classes of Fit

FOR MACHINE SCREW SIZES

MACHINE SCREW SIZES	THREADS PER INCH			CLASS OF FIT			
	N. C.	N. F.	N. S.	1	2	3	4
0		80		PG1	PG1	PG1	
1	64			PG1	PG1	PG1	
		72		PG1	PG1	PG1	
2	56			PG1	PG1	PG1	
		64		PG1	PG1	PG1	
3	48			Cut	CG	PG1	
		56		Cut	CG	PG1	
4			36	Cut	CG	PG1	
	40			Cut	CG	PG1	
		48		Cut	CG	PG1	
5	40			Cut	CG	PG1	
		44		Cut	CG	PG1	
6	32			Cut	CG	PG1	
		40		Cut	CG	PG1	
8	32			Cut	CG	PG1	
		36		Cut	CG	PG1	
10	24			Cut	CG	PG1	
		32		Cut	CG	PG1	
12	24			Cut	CG	PG1	
		28		Cut	CG	PG1	
14			20	Cut	CG	PG2	
			24	CG	CG	PG1	

FOR FRACTIONAL SIZES

FRACTIONAL SIZES	THREADS PER INCH			CLASS OF FIT			
	N. C.	N. F.	N. S.	1	2	3	4
¼	20			Cut	CG	PG2	PG01
		28		CG	CG	PG1	PG01
5/16	18			Cut	CG	PG2	PG01
		24		CG	CG	PG1	PG01
⅜	16			Cut	CG	CG	PG01
		24		CG	CG	PG1	PG01
7/16	14			Cut	CG	CG	PG01
		20		CG	CG	PG2	PG01
½	13			Cut	CG	CG	PG01
		20		CG	CG	PG2	PG01
9/16	12			Cut	CG	CG	PG1
		18		CG	CG	PG2	PG1
⅝	11			Cut	CG	CG	PG1
		18		CG	CG	PG2	PG1
¾	10			Cut	CG	CG	PG1
		16		CG	CG	PG2	PG1
⅞	9			Cut	CG	CG	PG1
		14		CG	CG	PG2	PG1
1	8			Cut	CG	CG	PG1
		14		CG	CG	PG2	PG1
1⅛	7			CG	CG	CG	
		12		CG	CG	CG	
1¼	7			CG	CG	CG	
		12		CG	CG	CG	
1⅜	6			CG	CG	CG	
		12		CG	CG	CG	
1½	6			CG	CG	CG	
		12		CG	CG	CG	

Class 1—Loose Fit

—for threaded parts calling for quick assembly and permitting a generous amount of shake or play.

Class 2—Free Fit

—for threaded parts that may be assembled entirely or almost entirely with the fingers and permitting a slight amount of shake or play.

Class 3—Medium Fit

—for threaded parts which are to be assembled with the fingers entirely or almost entirely and having the minimum shake or play between members.

Class 4—Close Fit

—for threaded parts requiring the most exacting precision fit and calling for a screw driver or wrench for assembly.

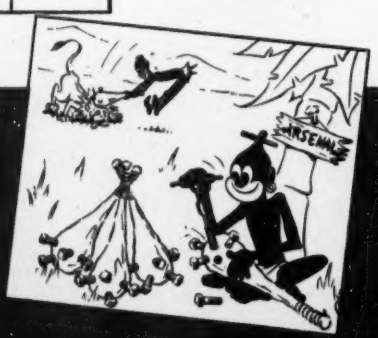
CUT Cut thread taps, either carbon or high speed.

CG Commercial Ground Thread Taps (High Speed).

PG2 Precision Ground Thread Taps (High Speed) with Pitch Diameter 2 Limit—Basic plus .0005″ to basic plus .0010″.

PG1 Precision Ground Thread Taps (High Speed) with Pitch Diameter 1 Limit—Basic to basic plus .0005″.

PG01 Precision Ground Thread Taps (High Speed) with Pitch Diameter 01 Limit—Basic to basic minus .0005″.



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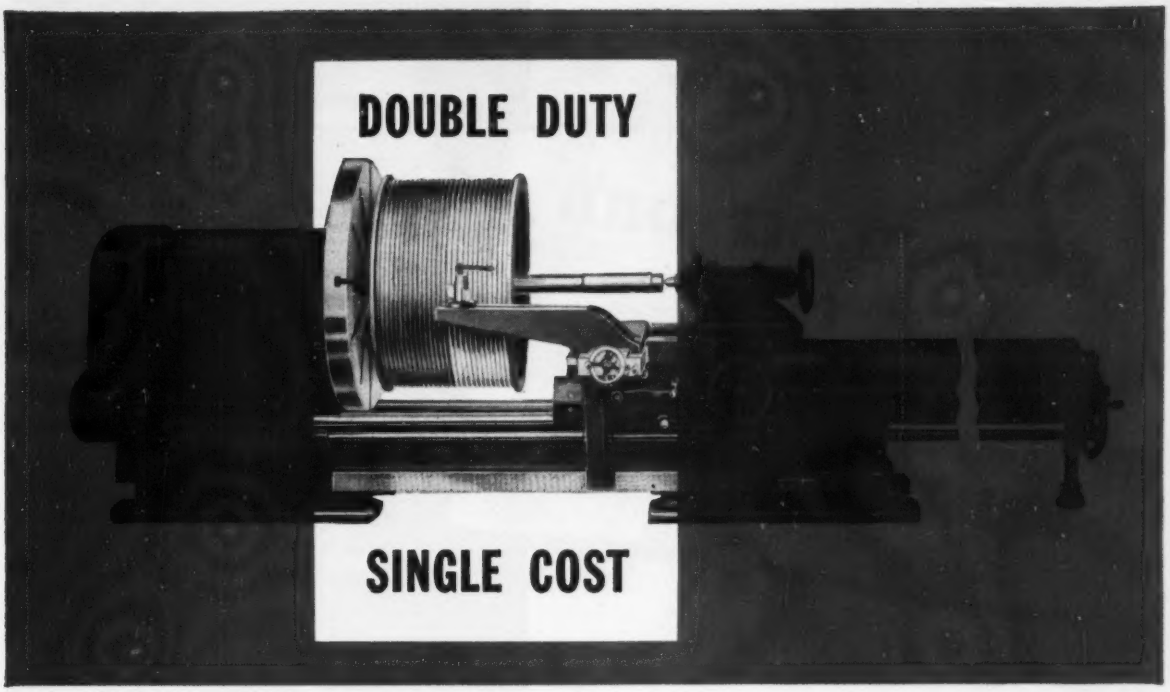

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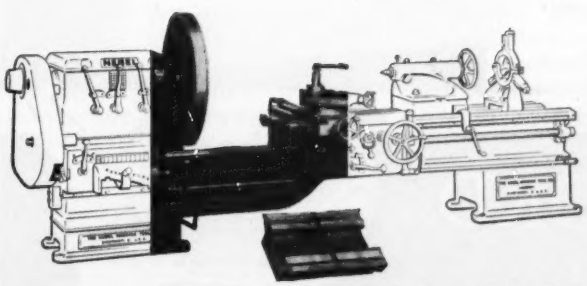

Increased swing capacity plus standard engine lathe advantages are yours with Nebel removable block gap lathes. Sizes: 18″/27″, 20″/30″, 25″/40″.

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DRILLING MACHINE

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NOTE THESE FEATURES

- Totally enclosed, fan cooled, ball bearing NEMA motor mounted at rear and driving through V belt.
- 20-tooth involute spline spindle for greater rigidity, less wear. Spindle independently counterbalanced with preloaded radial and thrust bearings and continuous lubrication.
- Two speeds or eight standard speeds with single or four speed motor and back gearing.
- Indicating shift provides instant speed changes — no complicated transmission.
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- Built-in light for each spindle.
- Box type ribbed table with platen machined to surface plate accuracy.
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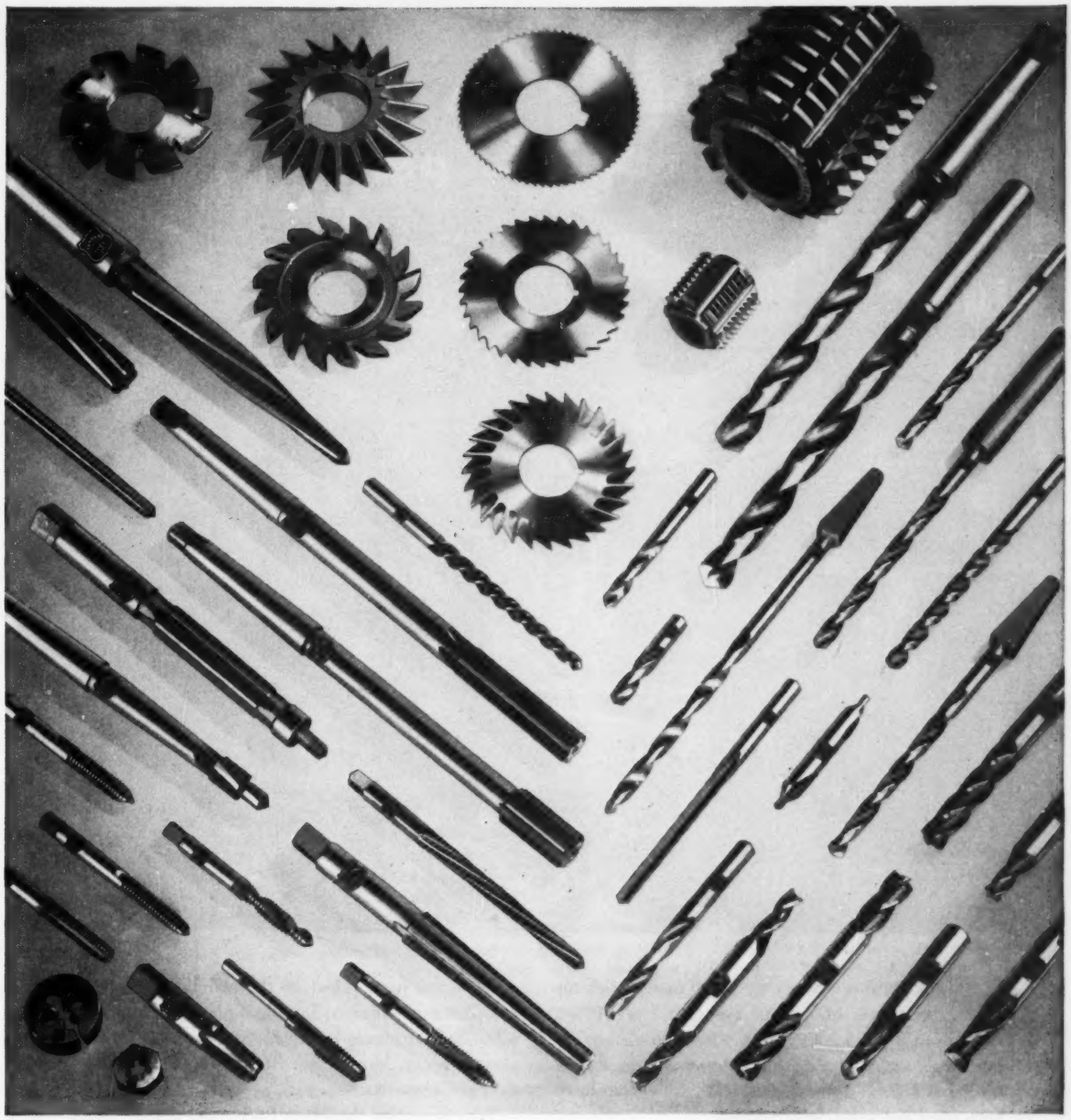

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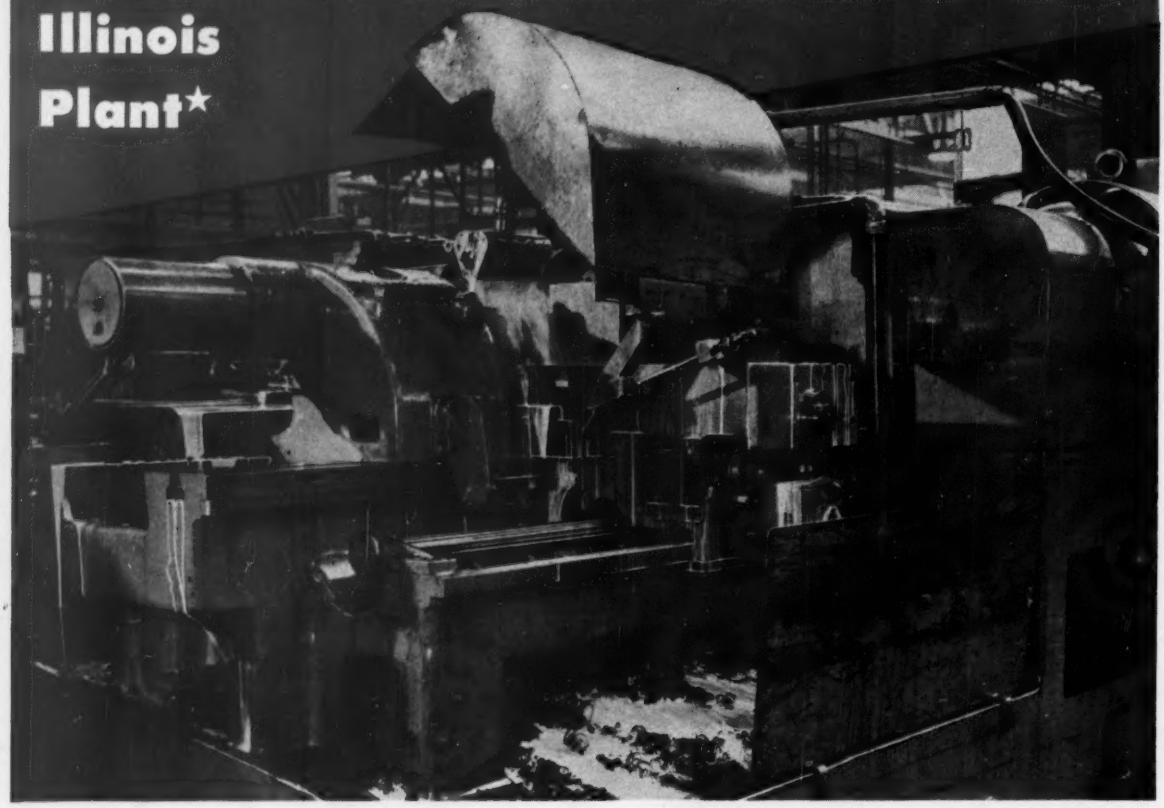

*Name on request.

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By LORING F. OVERMAN

Defense Planning May Go on for Fifty Years

AS Washington makes ready for the change of administrations, there is an official suspicion that defense planning may go on for a long, long time—perhaps as long as fifty years! Such timetable figures are being mentioned in big business circles, and then picked up by government men, not only by those in the fading Truman Administration, but also by incoming Eisenhower men. The five-decade total may be a figure pulled out of a hat, but the trend toward a defense program of unforeseeable duration is very definitely influencing Washington planning.

Machine Tool Outlook

Regardless of the political, business, or defense picture, it begins to appear that production equipment, including machine tools, will be classified from now on as munitions. Already part of a proposed budget for 1954 is an item somewhere near a billion dollars, earmarked to cover tooling which would be needed in the event of total mobilization. Plans for the earmarked funds were revealed in the first report of the Advisory Committee on Production Equipment —the so-called Vance Committee. Fundamentally, the Committee is in favor of increasing productive capacity, rather than stockpiling military end items which might become obsolete almost overnight. Just how this "overtooling" is to be accomplished is an issue that has yet to be decided.

There are areas of difference between what the Vance Committee has in mind, and what is recommended by Ralph S. Howe, chief of the Metal-Working Division of the National Production Administration. Mr. Howe explains his plan as follows: "If we are to prepare ourselves for an all-out war, unquestionably some shadow plants should be constructed for the production of specific military items. There should be a continuing policy to keep these facilities up to date, and to take advantage of improvements as they develop. A shadow plant to produce jet engines, for example, would still be 90 per cent useful even if the design of the engine is changed. We know that even to get pilot lines started from scratch is a problem. While we still have time, these shadow plants should be seriously considered."

The Vance Committee is reported as not being yet ready to accept the Howe plan.

Coordinating Order Issued

To coordinate the Howe and Vance ideas, as well as any others which may be involved, the Office of Defense Mobilization has issued DMO Order 23, entitled "Agency Responsibility in Completing and Maintaining the Mobilization Base." The order fixes responsibility among the Federal agencies concerned for various types of action necessary to complete the mobilization base. It provides for the coordination of activities for such essential elements as raw materials, facilities, production equipment, organization, and manpower.

Two assignments under the order are of particular interest to the machinery and machine tool industries: Paragraph 19 (a) of the order assigns to the Defense Production Administration "primary responsibility for encouraging the expansion of industrial capacity and services by private enterprise, with the use, where appropriate, of government aids for projects determined to be in the interest of national defense." Paragraph 19 (f) comments: "When necessary to supplement capacity provided above, acquiring a selected reserve of machine tools and production equipment and, where practicable and desirable, putting these tools and equipment in place," primary responsibility rests with the Department of Defense.

Improving Climate

The machinery industry should find it encouraging to know that decisions involving "facilities to supplement those of private enterprise" will rest in the hands of a Secretary of Defense who knows industry and its problems. He is Charles E. Wilson, head of General Motors Corporation, the nation's largest manufacturing concern. In his new job, Mr. Wilson now heads the Government's biggest business—defense.

Presence of a production man at the helm of the great defense production project is just one of many signs that the business climate in Washington is due to improve. Although a new Administration may have difficulty in making adjustments quickly, the knowledge that someone with know-how is "trying" will be helpful.

For example, there is reason to believe that the new Administration will lend an ear to the Ralph S. Howe proposal that there be some reform in the federal tax structure, so that both builders and buyers of production equipment can more quickly recover their investment in capital equipment. "Such a tax reform would change the whole attitude of manufacturers toward rehabilitation and modernization of their production equipment," said Mr. Howe.

In urging encouragement for industry to place orders for needed equipment promptly, Mr. Howe had in mind the increasing spottiness of the demand picture. "Some machine tool companies," he said, "are currently operating at less than capacity due to short backlogs. They have completed their part of the current defense program. We have other builders who are still straining themselves to expand production in an effort to handle existing long and unwieldy backlogs."

IN an attempt to channel orders into the plants of those having idle capacity, NPA amended its Order M-41 (Metal-Working Machines–Delivery) to change the percentage split of machine tool production between military and civilian purchasers. The order previously designated a 70-30 split in favor of the military. As amended, it permits a 60-40 split except as to specified critical machine tools named in appended List D.

The amendment followed visits by NPA teams to thirty-two plants whose volume represents 56 per cent of the industry's monthly dollar shipments. Ten per cent of the plants reported an immediate need for orders to maintain their prevailing production rate. The industry has reported that civilian buyers are reluctant to place orders in the absence of any assurance of delivery dates. The amended version of M-41 prohibits the "bumping" of unrated orders by rated business if the unrated order has reached the scheduling date for the fourth ensuing month—the frozen period.

Precision PRODUCTION MACHINES

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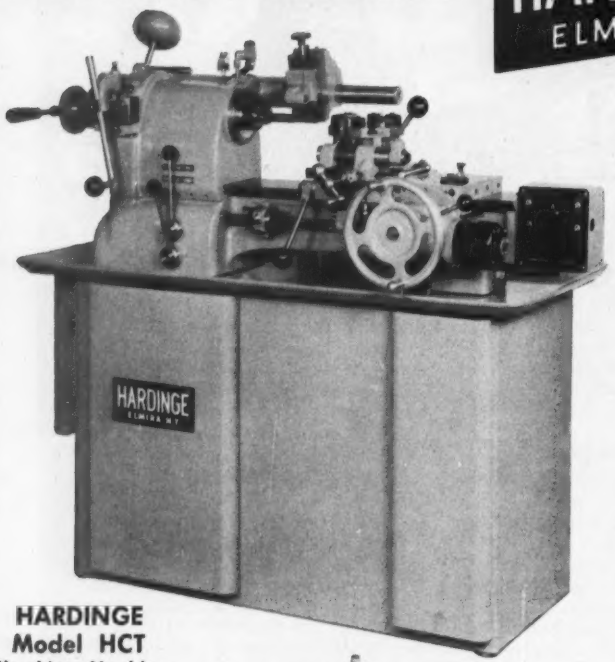

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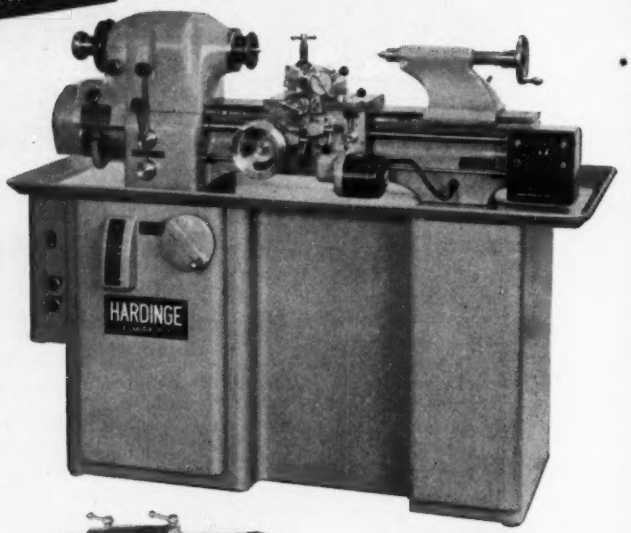

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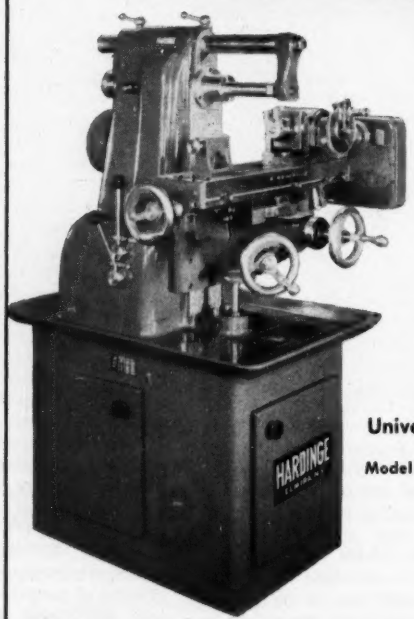

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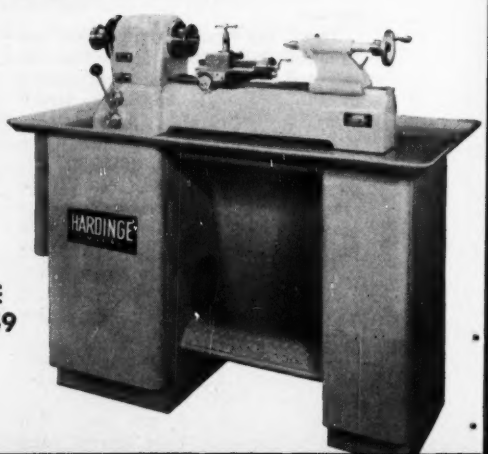

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Model DV 59
Lathe

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MACHINERY
JANUARY 1953

A Better Deal for Everybody Beginning This Month

ONE of the heartwarming prospects for 1953 is that the Eisenhower Administration will endeavor to function for the welfare of all citizens. This is predicated by the high caliber of men who have been selected to serve in the new Cabinet. Men who, by past performance in industrial, legal, and political fields, have proved their capabilities in chosen professions. Men who will not be pushed around by crackpot theorists.

No longer will class be set up against class to the detriment of voting minorities. "Special interests" from now on will not necessarily be applied to industrial groups in an opprobrious manner as during the last two decades when the designation was fully as applicable to labor and agriculture but never termed as such in political circles.

The new year should be a propitious one for a better understanding between labor and management. The recent election proves conclusively that labor leaders cannot control rank-and-file votes. Intelligent workers by the hundreds of thousands refused to believe the Taft-Hartley Act to be the pernicious legislation that it had been called by these leaders ever since its enactment, in order to gain votes for the now defunct administration. Consequently, they and their families voted the Republican ticket. It is anticipated that the Taft-Hartley Act will soon be amended in an intelligent manner so that no fair-minded union member will be able to find fault with its provisions. This should mean its elimination as a political football.

Since the new Administration will not function as a lever for special groups in industry disputes, it will be up to business and labor leaders to solve their difficulties without official pressure being applied on behalf of either side. True collective bargaining should be the result. It is to be hoped that the new presidents of the two largest labor organizations will handle their problems with a farsighted vision that will be beneficial to both worker and employer.

Although most labor leaders were chagrined at the election results because they backed the wrong horse, they now have the opportunity to work with the new regime for industrial peace. A good place to start would be in the editorial columns of union papers. Harmony does not blossom on venomous attacks on industry.

Startling changes will not be suddenly apparent on the Washington scene. Time will be required to substitute efficiency for inefficiency. But there will be a different atmosphere, and industry will no longer feel that it is a stepchild on our Government's threshold.

Charles O. Herb

EDITOR

Which of these special-purpose steels do you need...*NOW?*

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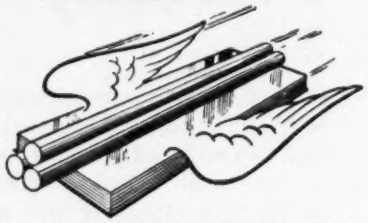
Right now, users of special purpose steels can get most of their requirements quickly—with one call to one convenient source. All the steels described on this page are in better-than-average supply at the Ryerson plant near you. All are high quality steels that conform to exacting specifications. Use this page to check the items *you* need, and save time by ordering them next time you call Ryerson.



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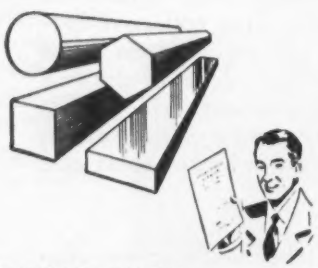

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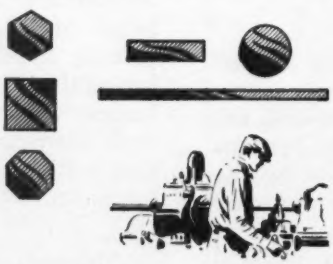

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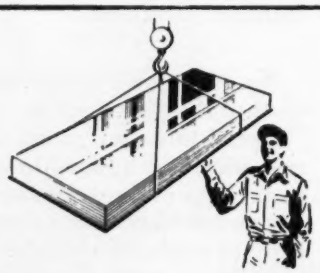

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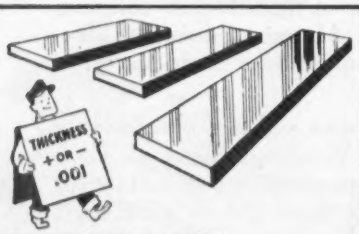

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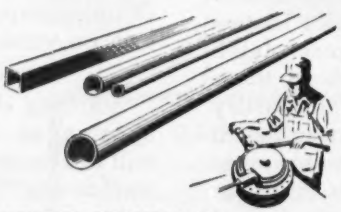

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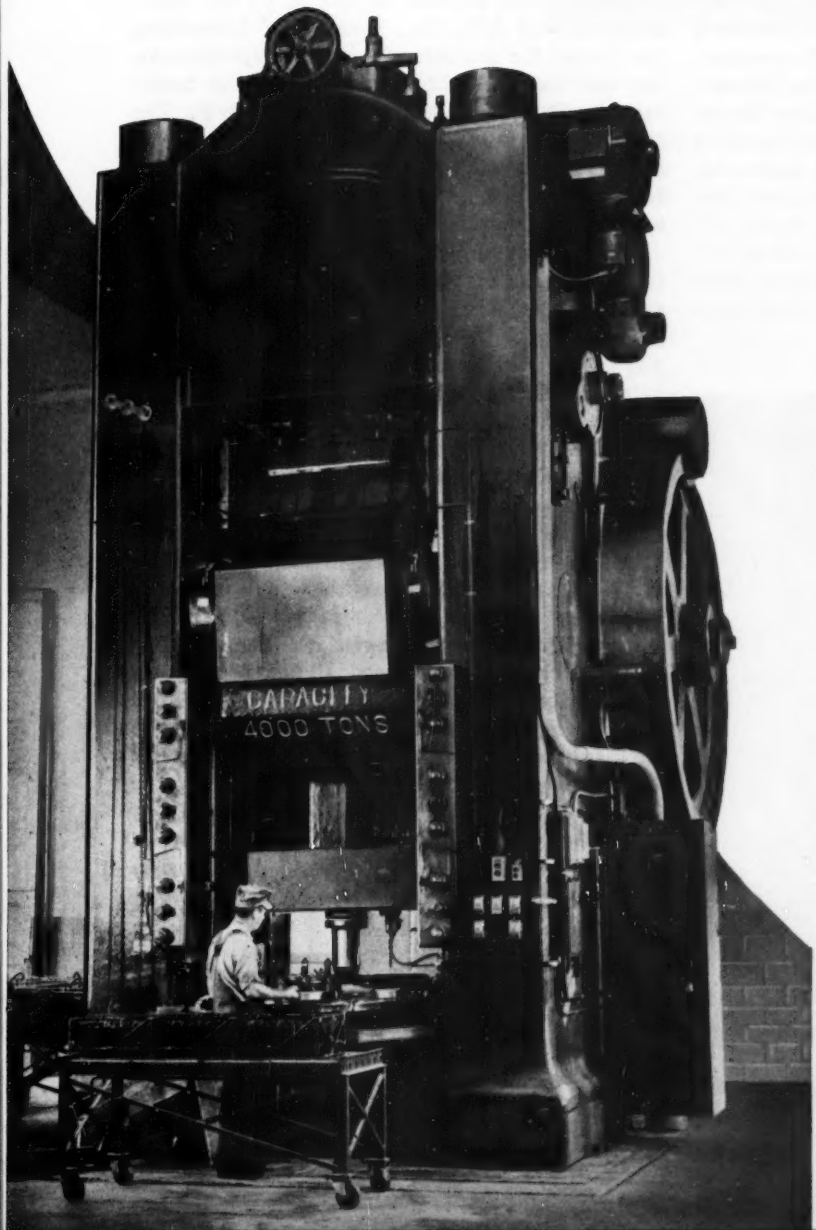
Huge Mechanical Press Speeds Production of Steel Cartridge Cases

By H. G. HRON, Works Manager
Regal Ware, Inc.
Kewaskum, Wis.



As a result of the critical shortage of brass during World War II, it was necessary to produce cartridge cases from steel. Today, most cartridge cases are still being made of steel due to a continuing brass shortage. Also, steel cases are lower in cost, and permit higher pressures in firing.

A major handicap affecting the production of steel cartridge cases, particularly those 80 millimeters or more in size, has been the lack of mechanical presses having a sufficient tonnage capacity. Up to this time, separate cupping and preheading operations, and five subsequent drawing operations, were necessary to produce steel cartridge cases for 105-millimeter howitzers. Now, cupping and preheading are done simultaneously and only three subsequent draws are required.

This faster, lower cost method has been made possible by installing a Bliss 4000-ton mechanical press, shown in the heading illustration, at the Kewaskum, Wis., plant of Regal Ware, Inc. The press is believed to have the highest tonnage capacity of any single-action, knuckle-joint type ever built. With the pressure available on this press, a much denser structure is obtained in the case due to

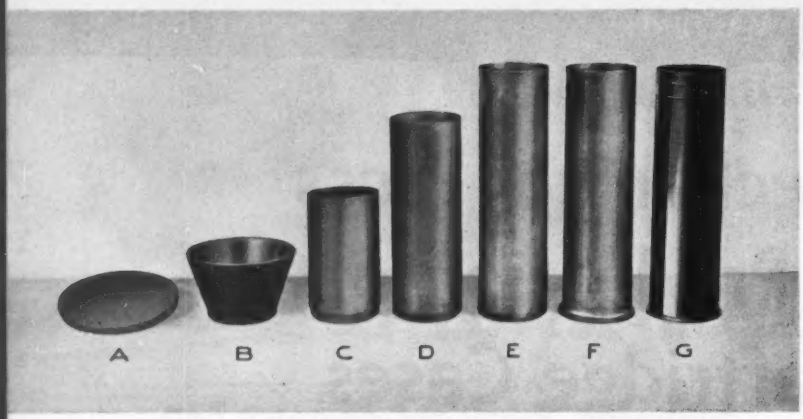


Fig. 1. Steel cartridge cases for 105-millimeter howitzers are drawn from round blanks (A). Cupping and preheading (B) are performed in one operation, and only three draws are necessary.

improved flow of the metal, sufficient metal is coined into the base of the cup for subsequent flanging, and higher production is possible.

Cartridge cases for these howitzers are drawn from blanks, *A* in Fig. 1, 7 3/8 inches in diameter by 0.515 inch thick. The blanks are made from spheroidized S A E 1030 steel. By purchasing round blanks of the required size directly from the steel mill, handling of scrap is eliminated. Each blank is visually examined for flaws or deep scratches in the metal that might become ironed into the case and cause failure when the shell is fired. Dimensions of the blanks are inspected only periodically. Identification of the heat number from which the work-pieces were made is accomplished by stamping a code number on each blank.

Prior to cupping and preheading, the steel blanks are chemically treated to provide a phosphate coating and a special heat-resistant, organic lubricant coating that permits severe cold-working. This process, developed by the Pennsylvania Salt Mfg. Co., consists of immersing the blanks for five minutes in a phosphate-coating solution called "Foscoat," which is maintained at a temperature of 180 degrees F. The specially formulated phosphate coating thus produced (at the rate of 1400 milligrams per square foot) is a strong, adherent coating that is chemically bonded to the steel blank.

After a water rinse, the parts are dipped for four minutes into a special organic lubricant called "Foslube," which is maintained at a temperature of 135 degrees F. The highly absorbent phosphate coating reacts chemically with the lubricant to form a heat-resistant lubricating surface, chemically interlocked with the steel, which is exceptionally adherent even under severe working conditions. Deeper drawing is thus possible and fewer operations are necessary. Also, metal pick-up and scoring of the tools have been minimized, thus increasing their life, and scrapping or breakage of the work-pieces is practically eliminated.

Cupping and preheading of the round lubricated blanks are performed simultaneously on the 4000-ton press. The press is equipped with a six-station, dial type indexing table, Fig. 2, and the blanks are placed in the dies as they pass the loading station. When this photograph was taken, the indexing table was only equipped with three dies, but now all six dies are in use.

The indexing mechanism is mechanically connected to the press ram. As the table is indexed

Fig. 2. Close-up view of the six-station dial type indexing table employed on the 4000-ton mechanical press seen in the heading illustration for cupping and preheading round blanks

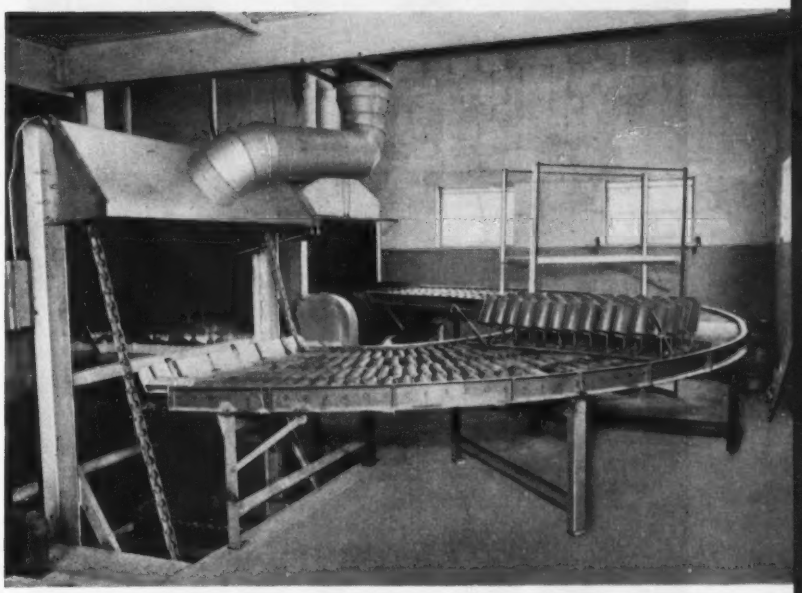


Fig. 3. A U-shaped gravity roller conveyor carries the work from the end of the pickling machine (center background) to the front end of the phosphate-coating and lubricating set-up.

counter-clockwise, the blanks are carried to a position directly below the punch. Here, each blank is cold coined into a tapered cup 3 1/2 inches deep, having a diameter across the top of 6 5/8 inches and across the bottom of 4 5/16 inches, as seen at *B* in Fig. 1. Wall thickness near the top is about 0.200 inch and, in the bottom of the cup, 0.415 inch. The punch has a 12-inch stroke, and operates at the rate of ten strokes per minute. A high-carbon high-chromium tool steel, hardened, ground, and highly polished, is used for this and all of the drawing punches.

This combination cupping and preheading is a most severe cold-working operation, and is possible only because of improved blank lubrication and the higher pressures available from the large mechanical press. Previously, cupping only was performed on a 300-ton press, and then the cups were preheaded on a 1500-ton press. With this method, five subsequent drawing operations were necessary, whereas only three are now required

The 4000-ton press is equipped with an air cushion knock-out for lifting the tapered cups from the dies. When the table is indexed, the cups slide over a plate mounted directly below the table and, just before reaching the loading station, fall through a chute onto a conveyor leading to the annealing oven. Here the cups are manually loaded into baskets before being placed on the oven conveyor.

Annealing of the cupped and preheaded parts is accomplished in a Despatch gas-fired continuous oven maintained at a temperature of 1200 degrees F. The work passes through the oven in thirty minutes, and is then sprayed with water for cooling and for loosening any scale formed during annealing.

Without reloading, the annealed cups automatically pass into a B. F. Goodrich continuous

Fig. 4. In performing the first drawing operation, tapered and preheaded cups (3 1/2 inches deep) are drawn into cylindrical cups 8 inches deep on this 36-inch stroke, 150-ton hydraulic press.

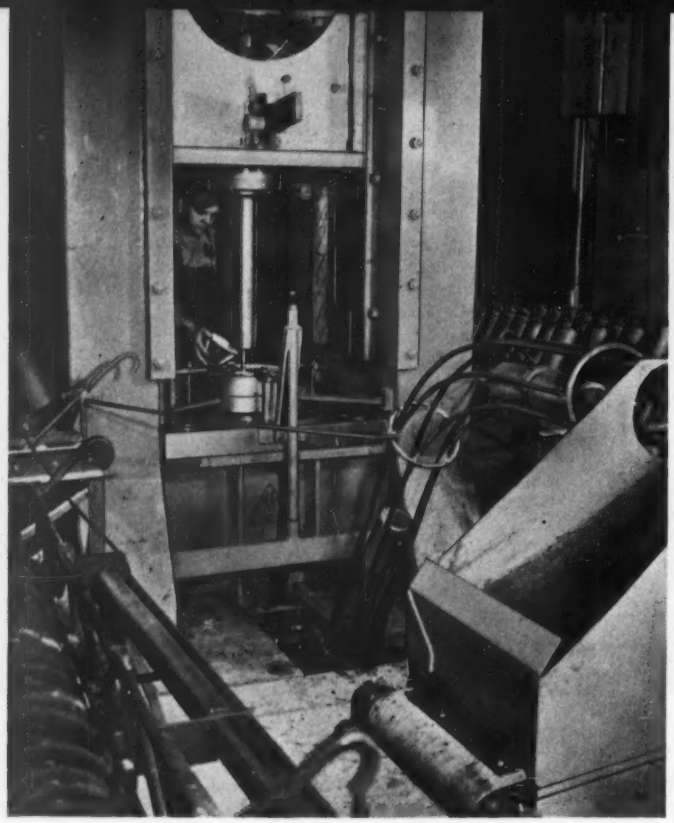


Fig. 5. Cups forced through the first drawing die fall into a chute and are pushed onto a belt conveyor leading to annealing racks.

spray type pickling machine. In this machine, the parts are successively sprayed with the pickling solution (containing 10 per cent by volume of sulphuric acid and maintained at a temperature of 160 degrees F.); cold water; a neutralizing agent; and hot water (160 degrees F.). Total cycle time for pickling is fifteen minutes. A U-shaped, gravity roller conveyor, Fig. 3, is provided to carry the work from the end of the pickling machine to the entrance of the Pennsalt installation. Here the parts are again phosphate-coated and lubricated by the same method as before. This requires sixteen minutes, including a cold water rinse between the Foscoat and Foslube immersions.

The first drawing operation is performed on the Clearing 36-inch stroke, 150-ton hydraulic press shown in Fig. 4. In this set-up, the tapered cup is drawn into a cylindrical cup approximately 8 inches deep and 4.490 inches in diameter, such as the one seen at *C* in Fig. 1. Thickness of the tapered wall near the open top of the cup is 0.0935 inch. It is intended to install a press capable of producing twice as many parts, or about 600 per hour. While only about 75 tons pressure is actually used for this operation, a larger capacity press is necessary because of the long stroke. Carbide dies are used for this and the two subsequent drawing operations.

When the cups are forced downward through the first drawing die by the punch, they enter a chute constructed of small tubes, Fig. 5. The cups are pushed upward through the chute and onto a belt conveyor, from which they are placed on racks. These racks are placed in the Despatch oven and the parts are again annealed, pickled, phosphate-coated, and lubricated.

The second draw on the 105-millimeter steel cartridge cases is performed on a Clearing 36-inch stroke, 100-ton hydraulic press. Only about 60 tons of the press capacity is used, and the ram travels at about 60 inches per minute. In this operation, the depth of the cylindrical cup is increased to about 13 1/4 inches, and its diameter reduced to 4.3675 inches, producing a cup such as the one seen at *D* in Fig. 1. While the thickness through the closed end of the partially drawn case remains unchanged, the bore of the case is tapered so that the side-wall thickness varies from 0.180 inch near the closed end to 0.052 inch at the open end. A production of 300 parts per hour is obtained from each of two presses.

As the cups are forced downward through this second drawing die, they again fall into a chute and are pushed upward onto a conveyor leading to the automatic feeding magazine on the V & O trimming machine shown in Fig. 6. A cam-operated slide at the bottom of the magazine aligns each case with a rotating arbor attached to the headstock spindle of the machine. An air-operated ram seen at the lower left then pushes the open end of the cartridge case onto the arbor. A band about 1/16 inch wide is

sheared from the open end of the case by a circular cutter fed against the revolving case. The cutter, 6 inches in diameter, is ground at an angle of 45 degrees to a knife edge so that there are no chips or burrs formed in the operation. A floating ring on the arbor and a positive feed-stop prevent the cutter from touching the arbor. The cases, trimmed to an over-all length of 12 inches, are automatically ejected on a conveyor belt by an air-operated rod in the center of the arbor.

The conveyor takes the cartridge cases to a Clearing 100-ton, 48-inch stroke hydraulic press, where the third and final drawing operation is performed. No further annealing or additional lubrication is necessary for this operation. About 50 tons maximum pressure is exerted to draw the 12-inch long trimmed cup to a depth of 15 1/4 inches and a diameter of 4.325 inches. Side-wall thickness varies from 0.080 to 0.035 inch, tapering toward the open end or mouth of the case. A completely drawn steel cartridge case for the 105-millimeter howitzer is shown at *E* in Fig. 1.

After trimming to an over-all length of 14 7/8 inches on another V & O machine, the steel cases are headed on the Cleveland 1200-ton, 6-inch stroke, knuckle-joint mechanical press shown in Fig. 7. Full tonnage of the press is required for this operation since considerable metal must be displaced in the closed end or head of the cartridge case. After heading, the thickness of the case at the center of the closed end is 0.580 inch, and in the flange at the periphery of the head, 0.280 inch.

The heading press, operated at fifteen strokes per minute, is equipped with a two-station shuttle feed for the die, with one operator on either side of the press. Each operator removes a headed case from the die as it shuttles back and forth, loads an unheaded case, and places the headed case in a tapering die on a press provided next to the heading press. Clearing 75-ton, straight-sided mechanical presses are used, producing a taper of 0.009687 inch per inch on the periphery of the shell. A headed and tapered case is shown at *F*, Fig. 1.

Heads of the steel cartridge cases are machined on New Britain four-spindle chucking machines, such as the one seen in Fig. 8. At the loading station, the cases are slipped into collets mounted on the spindle-carrier of the machine. When a case has been indexed counter-clockwise to the second station, its head is spot-drilled by means of a twist drill (lower right) mounted on the main tool-slide. Simultaneously, two single-point tools on the front cross-slide are advanced to rough-turn and rough-face the flange on the head. At the third station, a step drill mounted on the main tool-slide is used to drill and counterbore the head. Finally, single-point tools mounted on the rear cross-slide at the fourth station, finish-face, chamfer, and turn the head. Carbide-tipped tools are used for facing, turning, and chamfering, while the drills are high-speed steel. A production of 120 cartridge cases

Fig. 6. Steel cartridge cases that have been drawn for the second time are trimmed to an over-all length of 12 inches by means of a circular cutter fed against the revolving case.

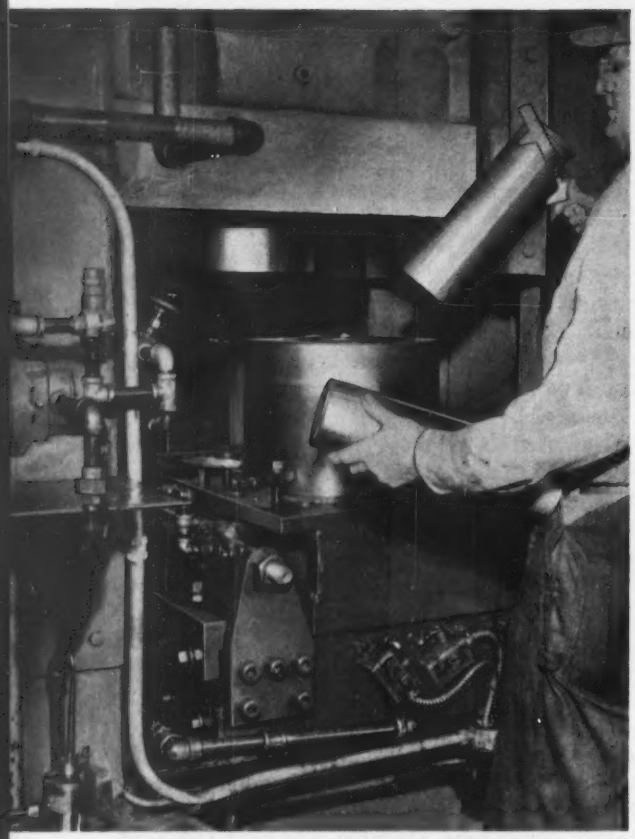


Fig. 7. A two-station shuttle feed is provided for the heading die on this 1200-ton mechanical press. One operator is stationed at each side of the press.

per hour can be obtained from each four-spindle chucking machine.

Thicknesses and diameters of the flanged head ends on the cartridge cases are inspected by means of Sheffield two-column Precisionaire gages such as the one shown in Fig. 9. Flange thickness is held to plus or minus 0.006 inch, and its diameter is machined within plus or minus 0.010 inch. Tolerances are clearly indicated by markers alongside the graduated scales on the face of the air gage, and the inspector can quickly see whether the part is within the specified tolerances by the location of the floats within the air columns.

After inspection of the flanged heads, the cartridge cases are trimmed to their final length of 14.625 inches, plus or minus 0.015 inch, on rotary roller-cutter machines especially designed and built by Regal Ware. Then two obturating rings, seen near the top of the cartridge case shown at *G* in Fig. 1, are roll-formed on special Whiting machines. The outside diameter of these rings, 4.233 inches, must be held to plus 0.000, minus 0.004 inch. These surfaces fit closely in the bore of the howitzer breech to prevent the escape of gas when firing.

The primer hole in the center of the flanged head is finish-counterbored and reamed on Delta drill presses. The reamed primer hole is held to plus or minus 0.001 inch. The steel cases are suspended on hangers from an overhead conveyor preparatory to washing and stress-relieving. First, the cases pass through a process washing machine where they are sprayed with a solution containing 1 ounce of alkali cleaner per gallon of water, maintained at a temperature of 80 degrees F. Then the cases continue through a Despatch continuous type, stress-relieving oven, where they are subjected to a temperature of 760 degrees F. for one hour.

Final dimensional inspection of the cartridge cases is accomplished on the Sheffield Multichek gage shown in Fig. 10. This multiple gaging instrument rapidly inspects seven dimensions simultaneously: two body diameters, the over-all length, the flange diameter and thickness, and the counterbore diameter and depth. An Electri-

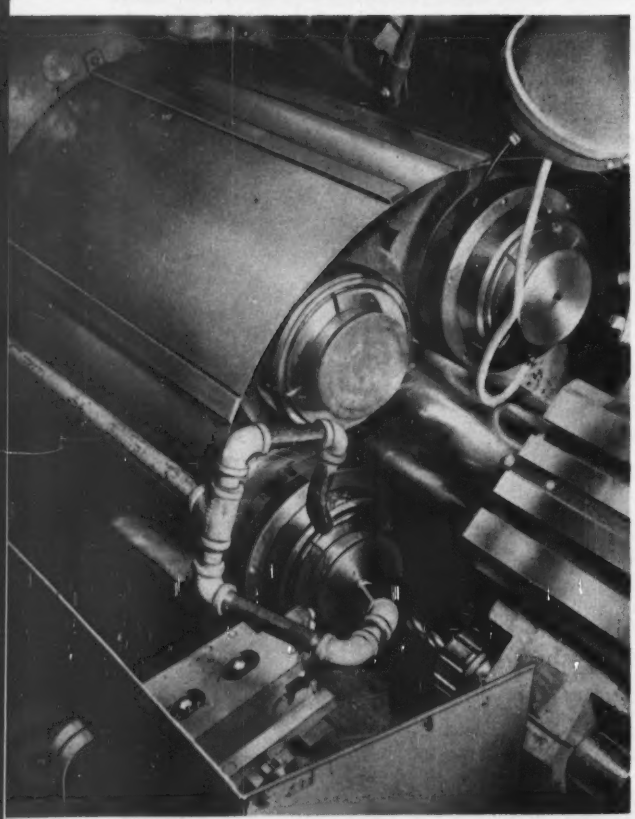
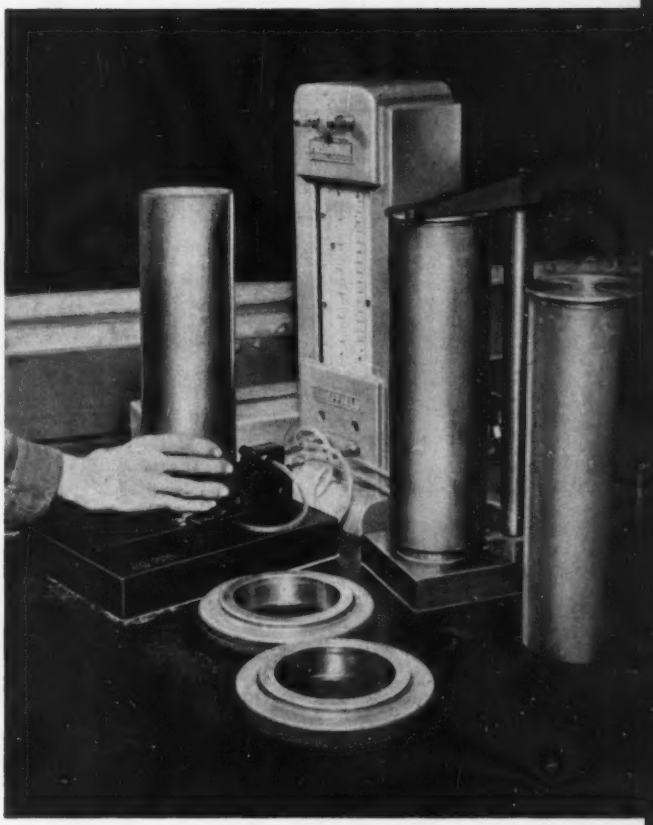


Fig. 8. Four-spindle chucking machines are employed to drill, counterbore, face, turn, and chamfer the headed ends of 105-millimeter steel cartridge cases at the rate of 120 per hour.

Fig. 9. A double-column air gage indicates whether the thicknesses and diameters of flanged head ends on the cartridge cases are within tolerances.



chek gaging head is provided for each dimension to be inspected, and a light panel seen on top of the gage has a diagram of the cartridge case and a signal light for each dimension.

Each gaging head illuminates either a red or a green light bulb, the former indicating that the particular dimension on the cartridge case is under size, while the latter shows that the part is over size. When both bulbs light simultaneously, they produce an amber color which indicates that the dimension of the case is within the specified tolerances.

Additional dimensions of the cartridge case that are inspected with other equipment at this time include the open-end or mouth diameter, the obturating ring diameter, the primer hole diameter, chamber profile, head thickness, and boss thickness. A 100 per cent visual inspection is also made to detect folds or flaws in the metal surface, or other imperfections.

Cartridge cases passing final inspection are stamped on a Bliss hydraulic marking press. This six-spindle press is equipped with a dial feed, and is capable of marking 600 cases per hour. After loading into baskets, the parts are cleaned and phosphate-coated in preparation for painting. This is performed in a B. F. Goodrich continuous machine in which the cartridge cases are successively sprayed with an alkali cleaning solution maintained at a temperature of 180 degrees F., a phosphoric-acid pickling solution at 160 degrees F., cold water, hot water (160 degrees F.), phosphatizing solution (also 160 degrees F.), and chromic acid. Then the cases pass through a drying oven held at 220 degrees F.

Painting of the steel cartridge cases, both inside and out, with a dark orange phenolic varnish is done with a DeVilbiss automatic, conveyorized paint spraying installation. Paint thickness is maintained at about 0.0005 inch. The paint is dried by conveying the cases through a gas-fired baking oven that is heated to a temperature of 400 degrees F. About twenty-six minutes is required for each case to pass through the oven. After another visual inspection to detect paint runs, orange peel, or bare spots, the cartridge cases are packed for shipment.

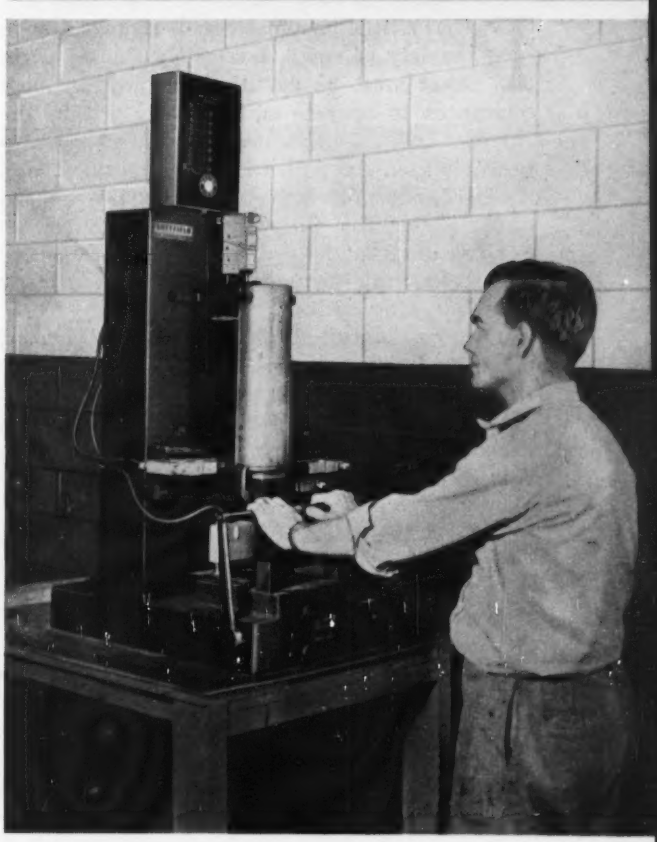


Fig. 10. Multiple gaging instrument rapidly inspects seven dimensions on the cartridge case at one time. Signal lights indicate whether each dimension is under or over size, or within tolerance.

Cost-Cutting Method of

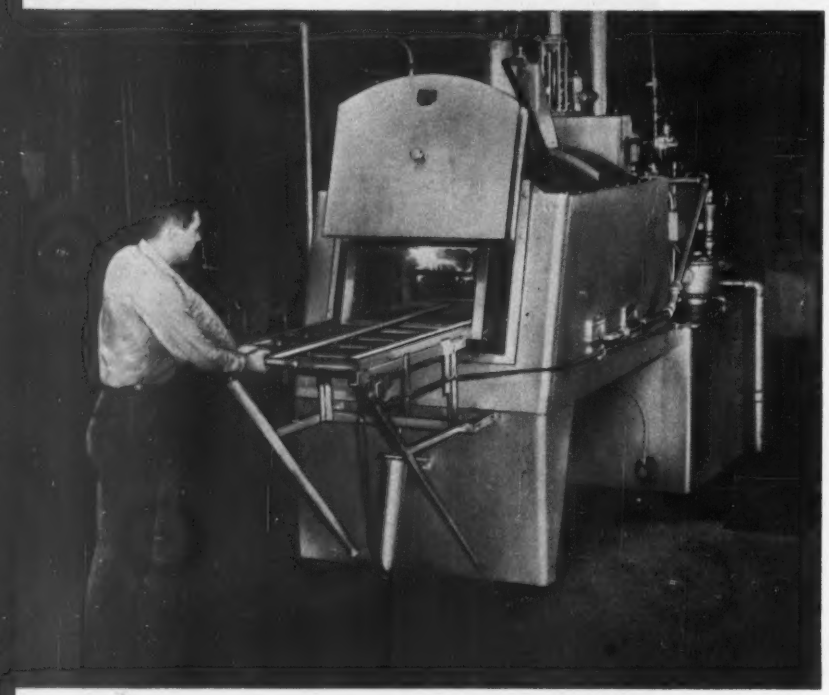


Fig. 1. Loading end of a gas-fired, controlled-atmosphere furnace employed to economically harden small parts on a production basis

PORTABLE pneumatic tools require a wide variety of small, intricately shaped parts that must be manufactured within close tolerances to operate satisfactorily within the compact tools. Difficulties encountered in heat-treating such parts have been eliminated, and production costs have been substantially reduced at the Keller Tool Co., Grand Haven, Mich., by the use of a batch type, controlled-atmosphere furnace having completely automatic heating and quenching cycles.

The gas-heated, bright-hardening furnace, made by Ipsen Industries, Inc., is directly connected and sealed to an automatic quench tank. Martempering, straight-hardening, carburizing, carbo-nitriding, and annealing can be performed on a production basis in the one furnace simply by varying the temperature, the atmosphere, or the time of the heating or cooling cycles.

In operation, a basketful of parts to be heat-treated is pushed through the front door onto the hearth of the furnace, as seen in Fig. 1. The furnace door is raised and lowered by a push-button controlled pneumatic cylinder. At the completion of a pre-set heating cycle, an air-operated door located between the heating and cooling chambers is automatically raised, and the basket of heated parts is moved onto an elevator in the cooling chamber by means of a chain conveyor.

A selector switch permits either oil-quenching or air-cooling of the work-pieces. When the switch has been set for air-cooling, the basket of parts remains on the elevator above the oil-quench tank for the required cooling time, and is then removed manually through the unloading door at the rear of the furnace. When oil-quenching has been pre-selected, the hydraulically actuated elevator automatically lowers the basket into the oil tank. The basket of parts is raised after the pre-set time, and removed manually as shown in Fig. 2.

A major advantage resulting in important savings is that this method of heat-treatment has made it possible to use less critical, lower-cost steels for many parts while gaining the same, if not better, results than formerly obtained with previous heat-treating methods and more expensive materials. In one instance, approximately 25 cents per pound is being saved by eliminating the need for an air-hardening steel. Since the average requirement for this type steel was 25,000 pounds per year, a single year's saving equalled 50 per cent of the total installation cost of the furnace.

Work treated in the controlled-atmosphere furnace is clean and bright. Cleaning costs have

Hardening Small Parts

Many Different Intricately Shaped Parts are Martempered, Carbo-Nitrided, Carburized, Straight-Hardened, or Annealed in a Batch Type, Controlled-Atmosphere Furnace having an Automatic Quench Tank. Lower Cost Steels Can be Used, and Cleaning and Straightening Operations have been Reduced.

By CLAUDE C. DIERDORF, Metallurgist
Keller Tool Co., Grand Haven, Mich.

been greatly reduced, since it is only necessary to remove quenching oil from the parts. Also, distortion of the work-pieces has been practically eliminated, thus making costly straightening operations unnecessary.

Another important advantage is that the furnace can be operated by inexperienced help, thus solving a critical manpower problem. By printing simple operating procedure sheets for the various parts to be heat-treated, production requirements are handled rapidly and at lower cost with less experienced personnel.

Typical work-pieces being heat-treated in this furnace are shown in Fig. 3. The cotton-picker rod seen in the center is 6 1/2 inches long by 1/4 inch in diameter, and is made from a spring steel containing about 0.70 per cent carbon. With previous methods of hardening, average production was only 250 per hour, and it was impossible to maintain straightness closer than 0.010 inch. This distortion necessitated additional straightening operations.

Now, approximately 500 rods are hardened at one time, in a thirty-minute cycle, with the bright-hardening furnace. This represents a 400 per cent increase in production. The work is heated to a temperature of 1475 degrees F. and automatically quenched in oil maintained at a temperature of 250 degrees F. Straightness of the rods is easily maintained within 0.005 inch. After removal from the furnace, the parts are drawn to a hardness of 53 Rockwell C.

The spindle gear for a rotary pneumatic tool, seen at the lower left in the illustration, is 2 1/4

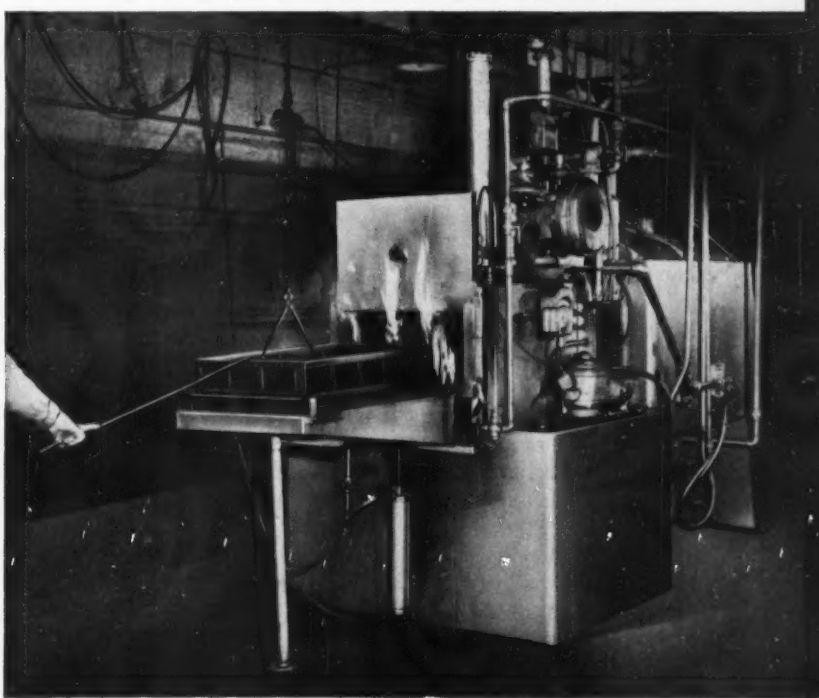


Fig. 2. Here a basket of automatically quenched parts is being manually pulled from the unloading door at the rear of the furnace seen in Fig. 1.

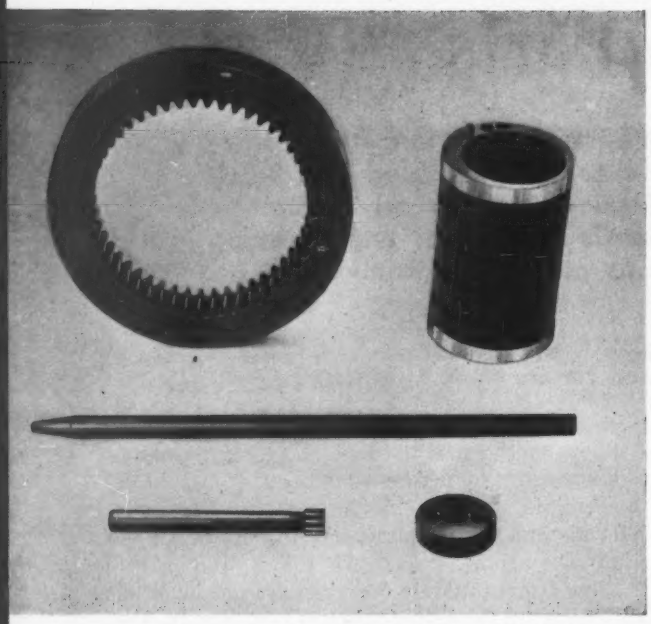


Fig. 3. Typical parts for portable pneumatic tools and a cotton-picker rod (center) that are heat-treated in the controlled-atmosphere furnace. The work comes from the furnace clean and bright, and distortion is practically eliminated.

inches long by 1/4 inch in diameter, and is made from a chromium-vanadium steel containing 0.70 per cent carbon. This part is a particularly difficult one to harden because of a hole drilled axially through the center and an elongated keyway on the periphery. With the former heat-treating mehods, in which parts were suspended vertically from a fixture, each gear had to be straightened and cleaning costs were high.

In the Ipsen furnace, the spindle gears are racked vertically in a basket fixture, heated to 1550 degrees F., quenched in oil (250 degrees F.), and drawn to obtain a uniform hardness of about 50 Rockwell C. Maximum run-out of the gear-shafts is 0.003 inch, and cleaning and straightening operations have been entirely eliminated.

The previous method of manufacturing the pneumatic tool ring gear (upper left in Fig. 3) entailed heat-treating in blank form, then drawing back to a hardness of 25 to 30 Rockwell C prior to machining and broaching of the teeth. Now, production methods have been simplified by hardening parts in the controlled-atmosphere furnace subsequent to machining. Final hardness of the gear is between 45 and 50 Rockwell C, resulting in a more wear-resistant part than was previously obtained. Also, a cleaning operation has been eliminated with this improved method.

The ring gears, made from S A E 4140 chromium-molybdenum steel, have an outside diameter of 4 inches, an inside diameter of 2 3/4 inches, and are 1/2 inch thick. A heat-treating temperature of 1550 degrees F. is employed, and the quenching oil is again maintained at 250 degrees F. The maximum change in the outside diameter of the gear after hardening is maintained within 0.002 inch.

Pneumatic tool cylinders, such as the one shown at the upper right in Fig. 3, were formerly made from an air-hardening tool steel. With the previous method of heat-treatment pickling was required to remove the scale. Also, because of the eccentricity of this work-piece—which measures 1 3/4 inches in diameter by 2 1/2 inches long—it was difficult to avoid distortion. For this reason, heat-treated cylinders had to be finish-ground to size.

These cylinders are now manufactured from lower cost AISI C1117 steel, which is carbo-nitrided at a temperature of 1600 degrees F. to a case depth of between 0.012 and 0.015 inch, and quenched in oil, again maintained at 250 degrees F. Run-out after heat-treatment is held within 0.003 inch, and the bore of the cylinder is quickly finished by means of a simple honing operation.

One final example of the economies resulting from the use of this furnace is in the heat-treatment of the idler gear plate shown at the lower right. The plate, made from S A E 4140 steel, is 1 inch in diameter, and has a 5/16-inch diameter center shaft hole and two 3/16-inch diameter pin holes. With the former heat-treatment —performed prior to piercing and reaming the holes—a Rockwell hardness of only 40 to 43 C was obtained. Now, by reaming the holes before hardening, heating to 1550 degrees F., and oil-quenching at 250 degrees F., the Rockwell hardness of the plates has been increased to between 45 and 48 C. No further finishing of the holes is necessary, and a previously required cleaning operation has been eliminated.

The controlled-atmosphere furnace is heated by four burners firing around a full muffle. An endothermic gas generator (not visible) produces the protective atmosphere employed in the furnace. Ammonia gas is mixed with the prepared atmosphere for carbo-nitriding. A continuous supply of gas is fed to the furnace to compensate for the atmosphere that burns off at the top of the furnace. Automatic means are provided to insure that the intermediate door (between the heating and cooling chambers) and the unloading door cannot be raised simultaneously. This prevents contamination of the atmosphere in the heating chamber.

Pneumatic Systems in Machine Design and Control

By H. C. TOWN

THE ultimate aim in good machine design is to employ as simple a construction as possible, with the choice of the power medium usually being made from the four commonly available—namely, mechanical, electrical, hydraulic, and pneumatic. Two or more of these mediums may often be used in combination.

Speed, simplicity, flexibility, and power amplification are the chief advantages of pneumatic operation. Examples of suitable applications include clamping devices, work feeding and ejecting devices, operation of control levers and clutches, air cushions, and the driving of machine spindles at high speeds. One limitation of pneumatic power is that high pressures are not readily obtainable, and with the usual plant pressure of 80 pounds per square inch, cylinder diameters may have to be prohibitively large for particular purposes. Also, air is unsuitable as a precision feed medium owing to its compressibility. Controlled speed is possible with air cylinders, but not against varying resistance, whereas hydraulic systems will permit steady movements at rates which can be readily adjusted.

Compressed air is the better medium where speed is required, for its velocity may be far greater than is practicable with fluids such as oil. From 8 to 15 feet per second is a suitable oil flow speed for machine operation, and up to 30 feet per second for occasional movements. The velocity of compressed air, however, at 80 pounds per square inch is 600 feet per second, so that an air cylinder will operate very rapidly. On railway freight-car brake systems, the action is transmitted at 950 feet per second, with sufficient power on a single pipe line to stop a long train traveling at 50 miles per hour in half its length.

Another advantage of compressed air is its reliability in widely varying temperatures. Pneumatic systems function equally well at temperatures of 300 degrees F., as in the glass industry,

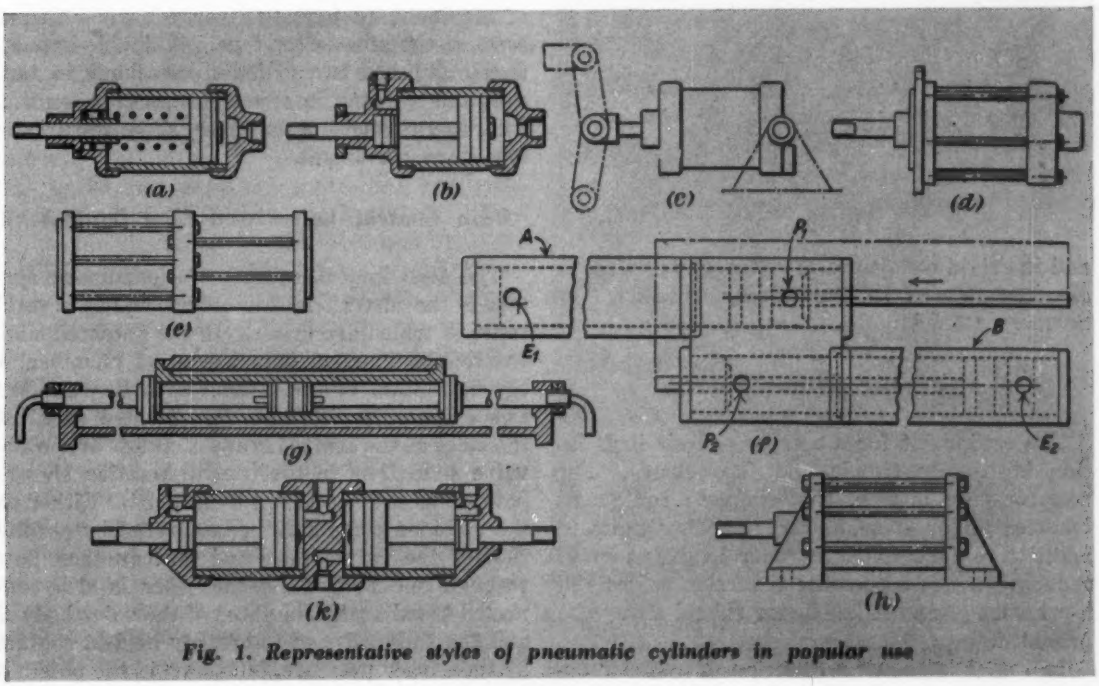


Fig. 1. Representative styles of pneumatic cylinders in popular use

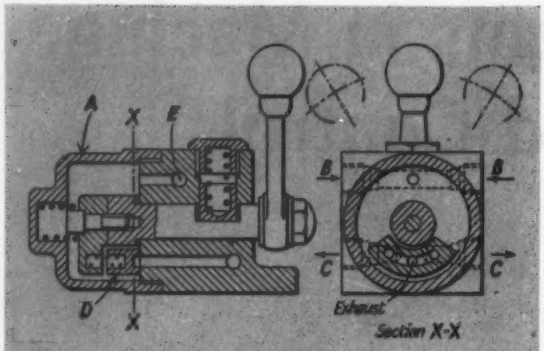


Fig. 2. Oscillating type valve employed for directional control.

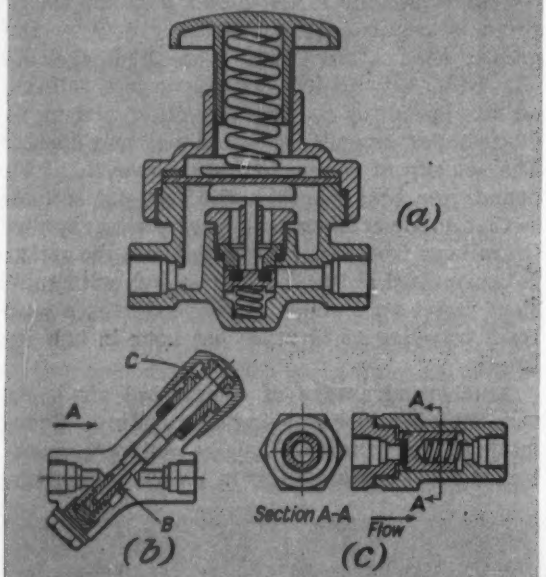


Fig. 3. (a) Diaphragm type pressure reducing valve; (b) regulator for controlling volumetric flow; and (c) sectional view of a non-return valve

and in frigid conditions of outdoor exposure, as are encountered in the mining industries of northern Canada.

Cylinder Arrangements

The equipment for a compressed air installation is usually simple and inexpensive. For reciprocating motion, the complete equipment includes all or some of the following units in addition to the cylinder: a control valve; a speed reducing valve; a pressure reduction valve; and a pressure gage. A lubricator should always be provided.

In Fig. 1 is shown a selection of cylinder arrangements, the simplest type (*a*) having single action with a spring return. In this type the stroke length is restricted. Under certain conditions, dust and grit may be drawn in through the breather holes, causing rapid wear. In general, the double-acting type (*b*) is more satisfactory. Trunnion mounted cylinders (*c*) may be employed for operating toggle linkages, with the advantage that pressure is maintained regardless of the positions of the levers. Consequently, fine setting just over dead center, as in purely mechanical clamping, is unnecessary.

Flange mounted cylinders (*d*) can be supplied to suit requirements, tie-rods being provided between the end and mounting flanges. To maintain the rigidity of cylinders exceeding 4 feet in length, the tie-rods are preferably divided. Such cylinders (*e*) are most suitable for pulling, with the piston-rods in tension, unless suitably stiffened to resist thrust loads.

Duplex cylinders (*f*) offer another means of providing a long stroke. In the design illustrated, a central cylinder block carries the left- and right-hand cylinders, *A* and *B*. Air is supplied to intake ports P_1 and P_2 in turn at each reversal, while the exhaust air vents at ports E_1 and E_2. Another design (*g*) differs from those thus far considered in that the piston-rod does not reciprocate but is fixed. Axial holes extend from each end of the cylinder to the piston in the center of the rod. Air entering intake ports on each side of the piston causes the cylinder and attached slide to travel along the bed.

Foot-mounted cylinders are often used, either of the double-foot type (*h*) or, for a short traverse, of the single-foot type. A double-impulse model (*k*) has two cylinders arranged in tandem and working in opposite directions—a useful design where a machine slide requires a two-stage movement.

Main Control Valves and Line Equipment

The most important unit in a pneumatic system is the directional air control valve, several types of which are in use. In the patented slide valve, Fig. 2, air enters the valve chamber *A* through either of the intake ports *B*, while the two cylinder outlet ports are located at *C* at the sides of the central exhaust outlet. When the valve slide *D* is in the central position shown, both ports are connected to exhaust. Either of the cylinder ports may be uncovered by oscillation of the valve slide, and air can then flow through one port while the other is still connected to exhaust. The faces of the valve body *E* and the slide valve are normally held in contact by the supply pressure, but to avoid the possibil-

ity of grit entering between them when the supply is shut off, contact is maintained by a spring. A valve may be positive, maintaining pressure until manually returned, or self-exhausting, returning to the central position when released.

An automatic directional air control valve can be designed to give a wide variety of relay sequences when used in combination with impulse, unloader, or solenoid valves. One impulse valve employed for the remote control of automatic valves has an angular movement of 16 degrees each side of center, and is mechanically operated by rods, dogs, or cams; pressure-operated as in hydro-pneumatic systems; or electrically controlled. It may be single- or double-acting, and combined with an unloader valve. This latter unit serves as a safety valve which ceases to exhaust at a predetermined pressure, whereupon pressure is applied to the impulse valve. With a fall of pressure, the unloader valve closes, and the exhaust is opened, so that the impulse valve is free to move.

For successful operation of this type of unloader valve, constant air pressure is assured by fitting a reducing valve, Fig. 3 (*a*), in the supply line. The unloader should be set to lift at about 5 to 10 pounds per square inch below the anticipated minimum line pressure. The operating air cylinder should be of a capacity sufficient to function at a pressure of 5 to 10 pounds per square inch below that at which the valve is set to lift. The valve should be mounted close to the cylinder, and when a speed regulator is included in the line, it should be fitted between the valve and the cylinder. A reducing valve generally operates by diaphragm action to offer accurate and sensitive regulation from input pressure down to atmospheric pressure. The diaphragm is a synthetic rubber molding reinforced with fabric.

A speed regulator for controlling the volumetric flow of air is shown in Fig. 3 (*b*). Provision for throttling in the direction *A* is by means of the spring-loaded taper bushing *B*, but in the opposite direction a free flow is obtained. Adjustment is made by turning the cap to operate the screw *C*, which has a reduced diameter end for regulating the position of the taper bushing, and thus the amount of air flow restriction in one direction. With air flowing in the opposite direction, the bushing is caused to move down the stem of the screw *C*, against spring pressure, and an unobstructed passage is provided.

Where air flow is required in one direction only, a non-return valve, Fig. 3 (*c*), can be used in the line. Such a valve should be included in supply lines to air hoists and pneumatic chucks, where failure of pressure may be dangerous.

Jig and Fixture Equipment

A main control valve for pneumatically actuated jig and fixture equipment is illustrated in Fig. 4. This valve is a spring-loaded plunger type and controls single- or double-acting cylinders. It is available for simple hand operation in either direction, or for hand operation with a central "off" position. In this instance movement of the handle to the right enters the "on" position, in which the handle is retained by an

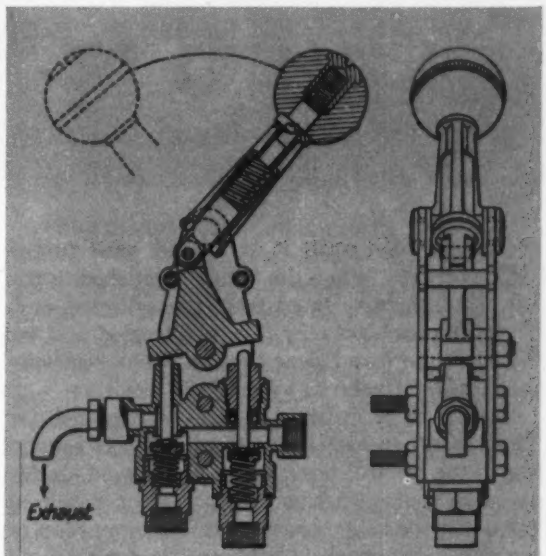


Fig. 4. Main control valve of the spring-loaded plunger type

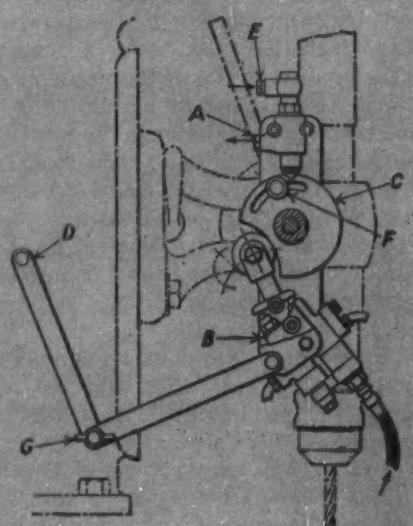


Fig. 5. Valves employed for work clamping and chip disposal in a drilling machine set-up

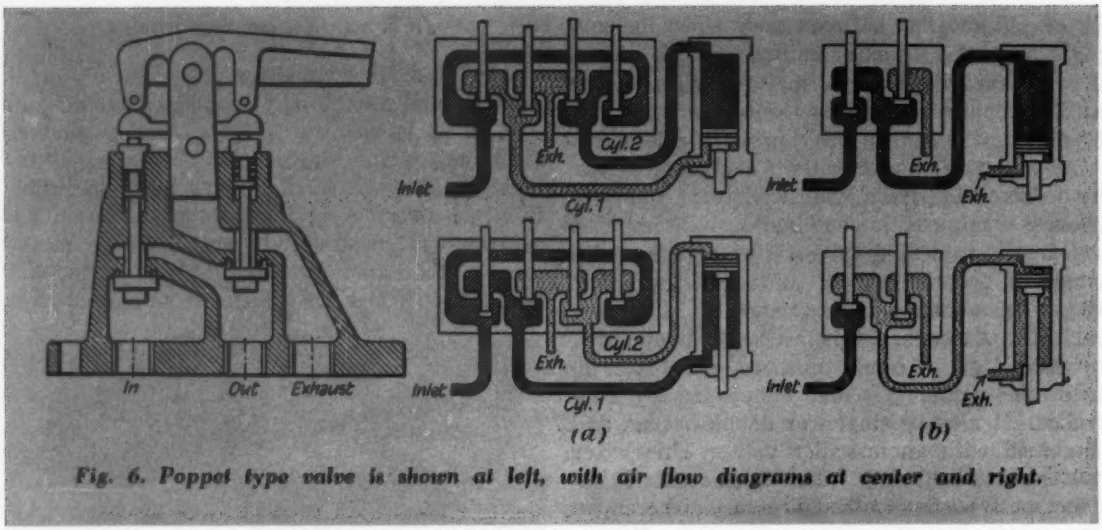


Fig. 6. Poppet type valve is shown at left, with air flow diagrams at center and right.

energized valve until it is pushed back to the "off" position. When the handle is pushed to the left, air is first released from the cylinder, and, if required, a blast may then be directed to eject the work-piece and clear the jig. Upon releasing the handle, it returns to the "off" position.

This type of valve can also be supplied for "dead man" operation, the handle always returning to the neutral position when released, or for cam and foot operation. With foot operation, a valve may be so arranged that, on depression of the pedal, the work is held, and is not released until the next depression.

Effective chip disposal facilitates high production with jigs and fixtures, and several valves are available incorporating this feature. These include a trip valve suitable for a hand press, where the upward stroke of the press opens the valve to release a blast of air onto the work. Another cleaning and ejector valve can be actuated by hand or power lever movement, and a puffer valve is available for clearing chips during an operation. This latter valve is provided with separate regulators to control the volume of air and the speed of the puff. A connection for an intermittent instead of a continuous blast of air can be provided.

An illustration showing how a main valve and a cleaning valve can function during a normal drilling cycle is seen in Fig. 5. At *A* is the cleaning, or ejector, valve, and at *B* a double cam-operated valve. The assembly can be attached to any drilling machine merely by bolting the rotary cam *C* to the end of the rack pinion shaft. The column of the machine is tapped for the torque arm bolt *D*, and adjustment of the spindle sleeve can be made without altering the valve timing, by means of the wing nut *G*. In operation, the downward movement of the drill spindle under the control of the lever *E* causes the cam *C* to operate the valve *B* and clamp the work. After drilling, the return movement of the spindle operates the valve *B* to release the work, while the adjustable dog *F* contacts the stem of the valve *A*, which supplies air to eject the work and clear the jig of chips. The operator is required merely to load the jig and feed the drill.

Poppet Type Operating Valves

In Fig. 6 is shown a sectional view of a four-way hand-controlled poppet type valve for a double-acting cylinder, diagrams (*a*) and (*b*) indicating the air flow for both a double-acting and a single-acting valve. The arrangement is of the locking type, the lever remaining in either working position until released by the operator. In the neutral position, both exhaust valves are lifted slightly from their seats, so that the two ends of the cylinder are open to exhaust, and the possibility of accident resulting from the piston creeping is eliminated. This feature applies also to the non-locking type valve, where the lever returns to the neutral position upon release.

The valve in Fig. 6 can be actuated in a number of ways, and the range of equipment includes subsidiary units such as shut-off, speed control, pilot control, and solenoid valves. There is also a "water-saver," or time delay, valve with an inlet at the top connected to an operating air cylinder which, when energized, allows pressure to be exerted on the valve piston to start the flow of water or other fluid. A needle assembly regulates the time that will elapse after the cylinder pressure has been exhausted, before the

valve closes, this period ranging from three seconds to three minutes.

Where such a valve is employed—for example on a screw machine fitted with an air chuck—it can be set so that the coolant will flow only when the machine is operating. Again, on a welding machine, the cooling water may be permitted to flow for a predetermined time after an operation has been completed. This arrangement keeps the electrodes cool, while automatically conserving water.

Solenoid Valves

Where electric switches or push-button controls are desirable, a solenoid valve is useful. The operation of such a valve is rapid, and it can be located in any position relative to the cylinder. Interlocking devices are readily provided and the valve may be controlled, if necessary, by a limit switch actuated by table dogs.

The potential life of a solenoid is not as great as that of the valve which it controls, since continued impact and fatigue stresses are heavy. Any means of reducing these stresses is therefore worthy of investigation. For this reason, consideration should be given to the use of solenoid-operated pilot valves that apply air pressure to actuate the main valves. The advantages of such a system are that a smaller solenoid is required to actuate the pilot valve as compared with the main valve; the armature travel may be only about 1/8 inch for a pilot valve, as against 1 to 1 1/2 inches for direct valve operation, thus producing rapid operation after the switch has been tripped; and less current is required for a smaller solenoid.

A solenoid-operated valve is shown in Fig. 7 (*a*). This particular unit is the four-way type. The valve is held in the "on" position by a spring, with the line pressure applied to one end of the cylinder. When the solenoid is energized, it overcomes the spring pressure, reverses the valve, and admits the line pressure to the opposite end of the cylinder. As soon as it is de-energized, the valve returns to the normal position. Double-solenoid valves can be supplied for certain applications which require a unit with a neutral position. Such valves can be designed to hold or release pressure in the "off" position and to lock in either position so that the solenoids need only be operated momentarily.

Pneumatic Circuits

The simplest reciprocating movements are obtained with a four-way valve as in Fig. 7 (*b*). This type of valve represents a combination of a normally open and a normally closed three-way valve. In many instances, particularly where close coupling on long cylinders is desired, the use of two three-way valves, Fig. 7 (*c*), is preferred. Where two separate valves are provided, air can be supplied at different pressures for the forward and return strokes. By employing a low pressure for the piston return, economy in the use of compressed air is obtained. For certain applications, valves may be integral parts

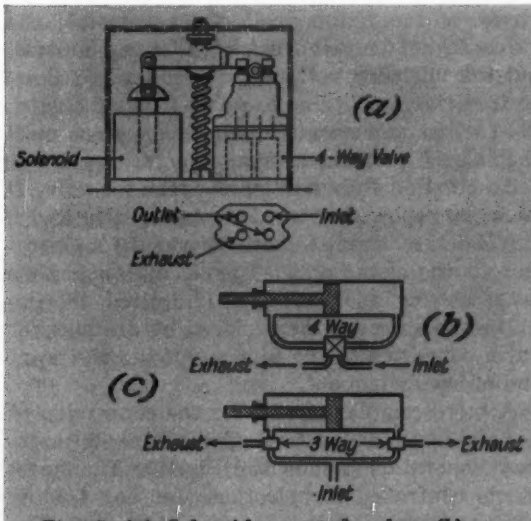
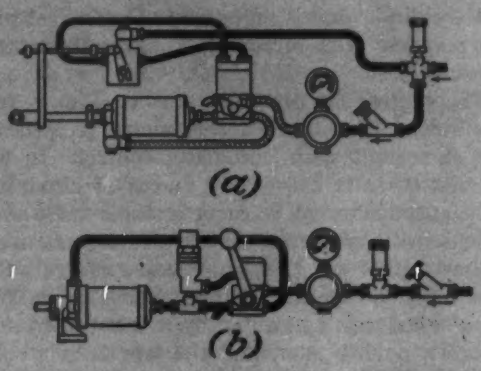


Fig. 7. (a) Solenoid-operated valve; (b) reciprocating movement with one four-way valve; and (c) reciprocating movement with two three-way valves

Fig. 8. (Below) Circuit for continuous automatic reciprocation is shown at (a), and circuit for manual forward movement with automatic return is shown at (b).



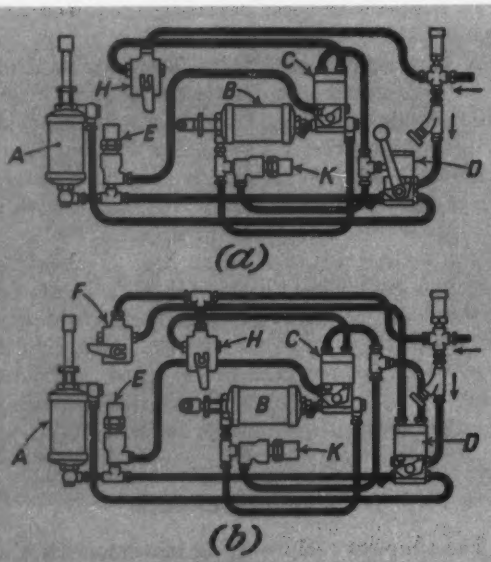


Fig. 9. (a) The piston in cylinder (A) is held in the advanced position while the piston in cylinder (B) makes forward and return movements. (b) The same circuit modified for fully automatic cycling

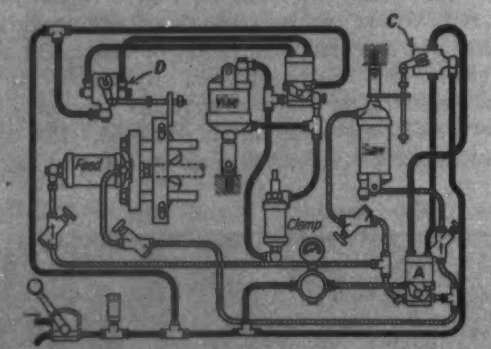


Fig. 10. Circuit for automatic operation of a power saw and work vise

of the cylinder heads, in order to obtain fast piston response with minimum wastage of air and pressure loss.

The typical circuit illustrated in Fig. 8 (*a*) is employed to obtain a continuous reciprocating movement with automatic control. In air circuits there is rarely any means of obtaining sufficient momentum to carry a single valve over the neutral position, so that two valves are used. Either a pilot or an impluse valve controls the air supply for operating an automatic valve. The impulse valve is connected by a trip-rod to any suitable moving part, and the length of stroke can be adjusted by means of stop-collars. If, as shown, a reducing valve is incorporated in the circuit, it is advisable to take the air supply for the impulse valve from the upstream side, to obtain reliable valve action even when the working pressure in the cylinder is low.

If hand and automatic controls are combined to insure that a piston will complete its stroke and then return, either a single-acting impulse valve or an unloader valve can be used as in Fig. 8 (*b*). It is advisable to incorporate a reducing valve into such a circuit, because a fall in supply pressure may interfere with the operation of the unloader valve.

In designing an automatic circuit, the function of each cylinder should be considered. For example, if the first operating cylinder is to provide for clamping, an unloader valve should be employed to trip the automatic valve controlling the supply to the next cylinder so that the second stage of the cycle cannot proceed until the clamp is functioning. In Fig. 9 (*a*), the piston in the cylinder *A* must be held in the forward position while the piston in the cylinder *B* makes a forward and return movement. An unloader valve *E* admits air to the automatic valve *C* only when the piston at *A* has completed its stroke. As the valve *C* is operated, the piston at *B* is advanced. The impulse valve *H* is operated by movement of the piston at *B*, and is connected to the control valve *C*. When the piston at *B* completes its forward stroke, the valve *H* is reversed and, in turn, reverses the valve *C*. After the piston at *B* has returned, the unloader valve *K* lifts, whereupon the valve *D* is moved to the "off" position and the valve *C* is set, ready for another forward stroke of the piston at *B*. On reversal of the valve *D*, not only is the piston at *A* returned, but the unloader valve *E* is permitted to close, so that the supply line to valve *C* is exhausted. No further movement can then take place until the valve *D* is again manually operated.

To obtain a fully automatic cycle, the valve *D* could be replaced by an automatic valve and a single-acting impulse valve provided for operation by the piston at *A*. The circuit would then be as shown in Fig. 9 (*b*). If desired, the impulse valve *F* could be replaced by an unloader valve connected to the pipe supplying the front end of the cylinder *A*.

A more complex circuit for the conversion of a hand-operated cutting-off machine to automatic operation is shown in Fig. 10. The movements controlled include those for bar feeding and clamping, as well as the feed of the saw. The impulse valve *C* is actuated from the saw cylinder, being tripped at either end of the piston stroke. This valve reverses automatic valve *A*, directing the supply to the saw and bar-feed cylinders, so that the stock is fed forward as

the saw advances for the cutting stroke. The saw is retarded by speed regulators so that the stock reaches the stop and the vise closes before cutting begins.

The reducing valve controls the supply to the saw and bar-feed cylinders only, full line pressure being available for the vise clamp cylinder and the two impulse valves *C* and *D*. For gripping the bar on the feed side of the vise, a small clamp cylinder is provided. This arrangement prevents the friction of the feed-fingers from dragging the bar back as the feed cylinder returns. Speed regulators should be incorporated in the circuits in accordance with requirements.

Conservation of Industrial Diamonds

THE Salvage Division of the National Production Authority, U. S. Department of Commerce, is conducting a nation-wide program for the conservation and reclamation of industrial diamonds. With present needs exceeding supply, everyone who handles industrial diamonds in any form must exercise intensive thrift in order to provide the volume and quality of carbide-tipped cutting tools essential to the metal-working industry.

Suggestions for instituting an industrial diamond salvage campaign at your plant include the following:

1. Salvage unused diamonds by making an immediate inspection and inventory of any accumulation of worn-out, broken, and obsolete diamond grinding wheels and tools. Your supplier will reimburse you for reclaimed diamonds returned to him.

2. Appoint someone with authority to form an in-plant salvage committee. Have the committee put into effect and enforce a program to improve salvage practices within the plant—bringing the importance of the program to the attention of all personnel who handle industrial diamonds in any form.

3. Welcome the representatives of your supplier, for they will instruct personnel in the best methods of salvaging diamonds in your plant.

4. Make a frequent check of wheel and tool handling and of swarf and sludge collection in order to keep in line with proper procedures. Make a survey every thirty days of potential salvable material—including obsolete diamond bearing wheels and tools. Collect all forms of diamond waste for proper disposition.

To prolong the life of industrial diamond wheels and tools:

1. Strictly control the initial use of diamond wheels, including rigid tool-crib control and proper wheel application to the job.

2. Control the use of diamond-tipped tools.

3. Train personnel to operate grinding wheels and cemented-carbide tools properly.

4. Use other abrasives whenever the application permits.

5. Mount diamonds in the tool shank to take advantage of the crystalline orientation of the stones being employed.

Although grinding wheels require 80 per cent of the crushing bort supply, as much as 50 per cent of the bort can be saved by the following recommended practices:

1. Back off the steel portions of carbide-tipped tools on aluminum-oxide grinding wheels, to avoid grinding of steel by the diamond wheel.

2. Prepare and rough-grind the cemented-carbide tools on silicon-carbide wheels.

3. Check spindles to keep them true and operating within close limits.

4. Mount diamond wheels with extreme care, to assure that back-plates, flanges, and spindles are clean, free from burrs or nicks, and running true.

5. Follow wheel manufacturers' speed recommendations.

6. Use diamond grinding wheels only when they are in excellent operating condition — cleaned and dressed.

7. Use metal- or vitrified-bonded diamond wheels instead of resinoid for off-hand grinding.

8. Grind wet whenever possible, for this permits a diamond bort saving of approximately 30 per cent over dry grinding.

9. Use a generous flow of coolant whenever practicable; otherwise use a mist coolant.

10. Grind cemented carbides on separate machines to keep diamond-wheel sludge separate from other sludges.

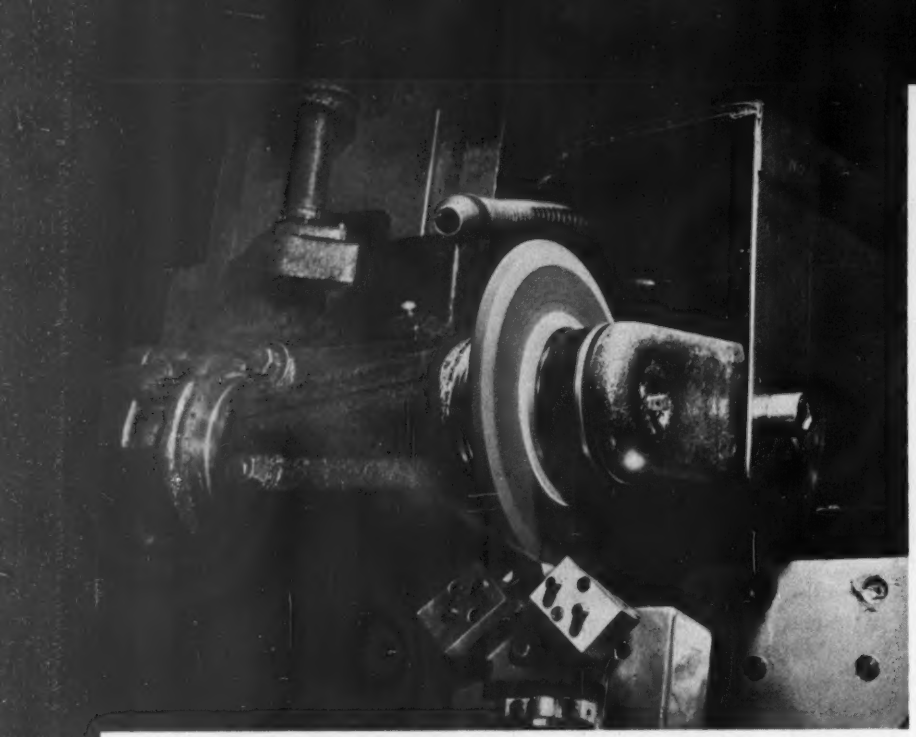
To salvage the maximum amount of bort during wet-grinding operations:

1. Save sludge from diamond wheels.

2. Add a settling tank to the wet-grinding machine to prevent run-off of diamond particles.

3. Collect sludge from diamond wheels separate from sludge of other abrasive wheels.

To lengthen the life of the wheel in dry grinding, a mist coolant or wick should be applied whenever possible. For swarf recovery, use converted vacuum cleaners having paper disposal bags, vacuum-cleaner disposal bags placed in the exhaust system connected to the grinding machine, or commercial dust collection units connected to the grinding machine.



Gear-Tooth Correct

By CHARLES H. WICK

RESISTANCE to surface wear and tooth breakage are the principal factors affecting the load-carrying capacity of gears. Fatigue failures often start in the root fillets of the gear teeth—which are the points of maximum stress concentration. Fig. 1 illustrates a photoelastic stress analysis obtained by photographing a loaded plastic gear under polarized light. The interference patterns show that the compressive stresses at contact surface *A* and the root fillet *B* tend to balance each other, while the tensile bending stresses acting on the left-hand root fillet *C* tend to break off the gear tooth at this point.

Subsequent inspection of precision-ground aircraft gears that had failed in service showed poor blending of the root fillets with the involute surfaces of the gear teeth. Since the gears failed by cracking through the root fillets of the teeth, it was concluded that the poor blending was a major factor contributing to the failures. In one case, an aircraft engine gear failure was traced to an interruption only 0.0005 inch high at the junction of the involute and the root fillet.

Although the specifications for precision aircraft gears do require full radii and near-perfect blending, it has been practically impossible to dress the gear grinding wheels within the required tolerances, even with skilled operators. With conventional abrasive-wheel dressing attachments, it has been necessary to dress the involute form on each side of the wheel with two separate diamonds (or one diamond and two setups), and the rounded corner—which joins the involute form and periphery of the wheel—with another diamond. To maintain the corner radii

Fig. 1. Photoelastic stress analysis shows stresses at the gear-tooth contact surface (A) and at root fillets (B) and (C).

Grinding Accuracy Depends on Dressing of Abrasive Wheel

By Means of the Magni-Form Contour Wheel Dresser, the Involute Formed Sides, Rounded Corners, and Periphery of Gear Grinding Wheels can be Continuously Dressed in One Automatic Cycle. Accurate Blending of Root Fillets Reduces Possibility of Gear Tooth Breakage

and blending within plus or minus 0.0005 inch, the location of the dressers had to be held within 0.0001 inch, and the diamond radius setting and stops for the corner dresser had to be set within 0.0001 inch.

By means of the Magni-Form contour wheel dresser, Fig. 2, made by the Hoglund Engineering & Mfg. Co., Inc., Berkeley Heights, N. J., the involute formed sides, rounded corners, and periphery of gear grinding wheels can be continuously dressed in one automatic cycle. The hydraulically actuated dresser is controlled by inclined planes rather than a pantograph mechanism, and employs only two diamonds. Each diamond dresses one involute side, the adjoining rounded corner, and one-half the periphery of the wheel, thus insuring perfect blending.

As shown in the drawing of the dresser, Fig. 3, the two diamonds *A* are held at an included angle of 72 degrees in a common holder *B*. This holder is located by means of a square key *C*, and is bolted to a plate *D* that is secured to a vertical slide *E*. Vertical movement of the diamond slide results from a follower *F* in contact with a contour-ratio cam (inclined plane) *G* having a 3 to 1 ratio. The contour-ratio cam is bolted to a horizontal slide *H* that is reciprocated by a follower *J* in contact with a pair of contour templates *K*.

Simultaneously, a main slide *L*, on which the contour slide is slidably mounted, is also traversed horizontally by a follower *M* in contact with a feed template *N* having a 10 to 1 ratio. Contour templates *K* are bolted to the top surface of a slide *O* and feed template *N* to the under side. This slide is reciprocated by a double-acting hydraulic cylinder *P*. The combination of motions obtained with this ingenious mechanism causes the diamonds, one at a time, to generate the desired involute forms (or any other

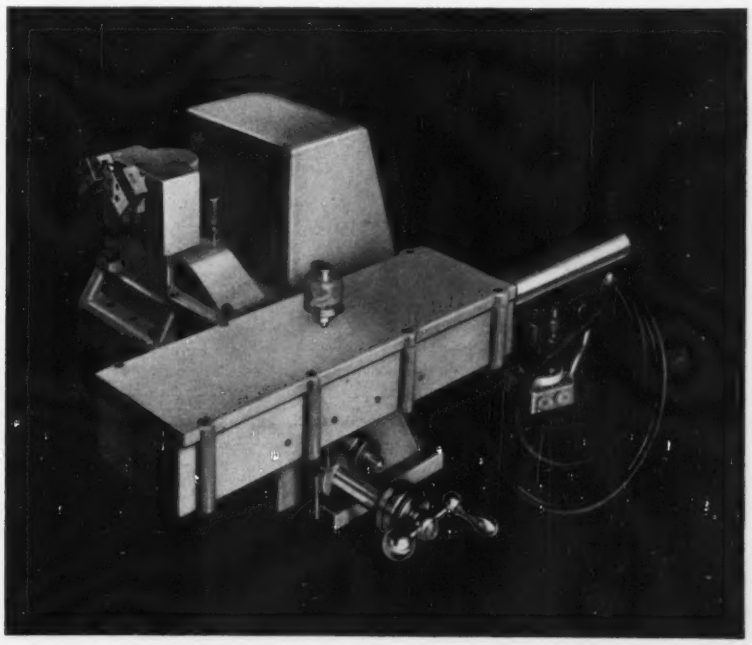


Fig. 2. Magni-Form contour wheel dresser is hydraulically actuated. Diamond movement is controlled by sliding inclined planes.

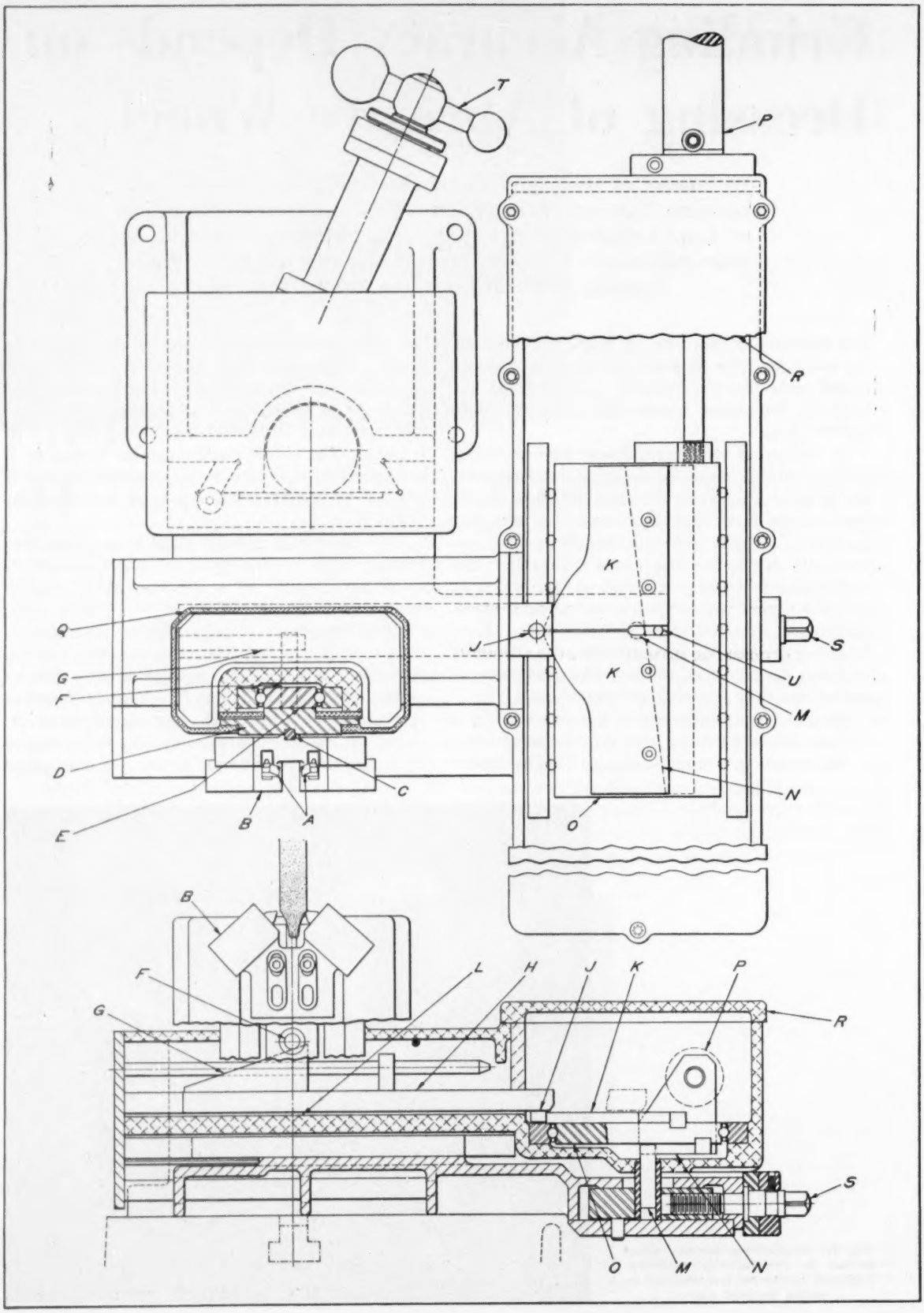

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Fig. 3. (Left) Drawing of the grinding wheel dresser illustrated in Fig. 2. Diamonds (A) are raised and lowered by contour cam (G), which is reciprocated by templates (K).

Fig. 4. (Right) A pair of dressing diamonds is accurately set in a common holder by means of a bench type microscope.

desired shapes) and rounded corners on the abrasive wheel.

The advantage of having a variable ratio on the contour-ratio cam *G* and the feed template *N* is that the contour templates can be distorted and made more than three times as long as they are wide. In this way, contour-template follower *J* need only climb at an angle of 45 degrees or less, while the dressing diamonds may traverse at an angle of 85 degrees or more. The ratios of the dresser can be changed simply by replacing the feed template and the contour-ratio cam. The pair of contour templates, which control the involute form or profile dressed on the abrasive wheel, need only be changed when a different gear, spline, or formed part is to be ground.

Ways on the dresser slides are heat-treated and ground, and move on hardened balls (held in retainers) to minimize friction. Templates and cams are made from Meehanite cast iron, and the followers from carbide. Cover *Q* is provided around the diamond slide and cover *R* over the templates to make the dresser dustproof and waterproof. This protection permits coolant to

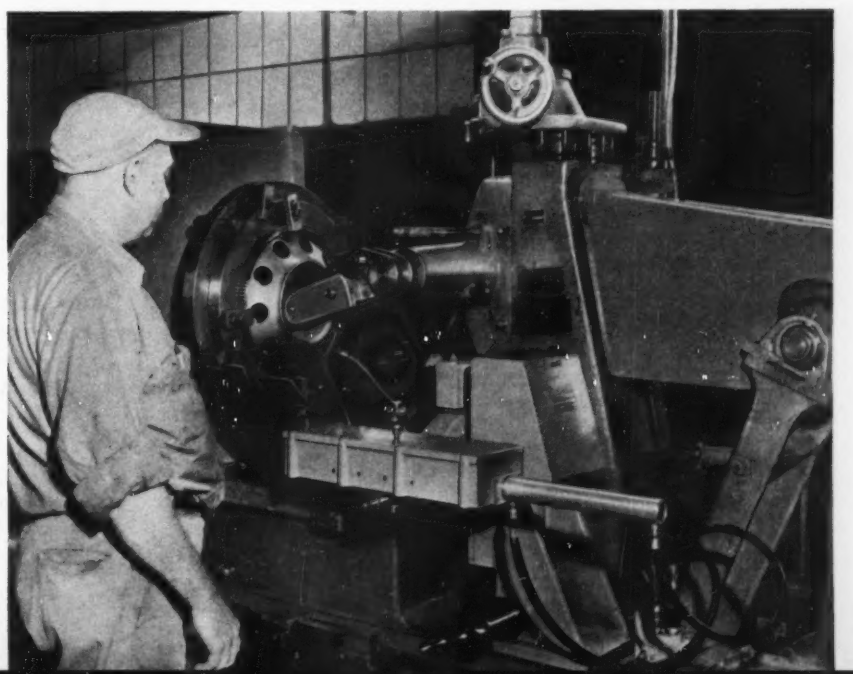


Fig. 5. A wheel dresser mounted on the bed of a machine used to grind reduction drive gears for aircraft engines

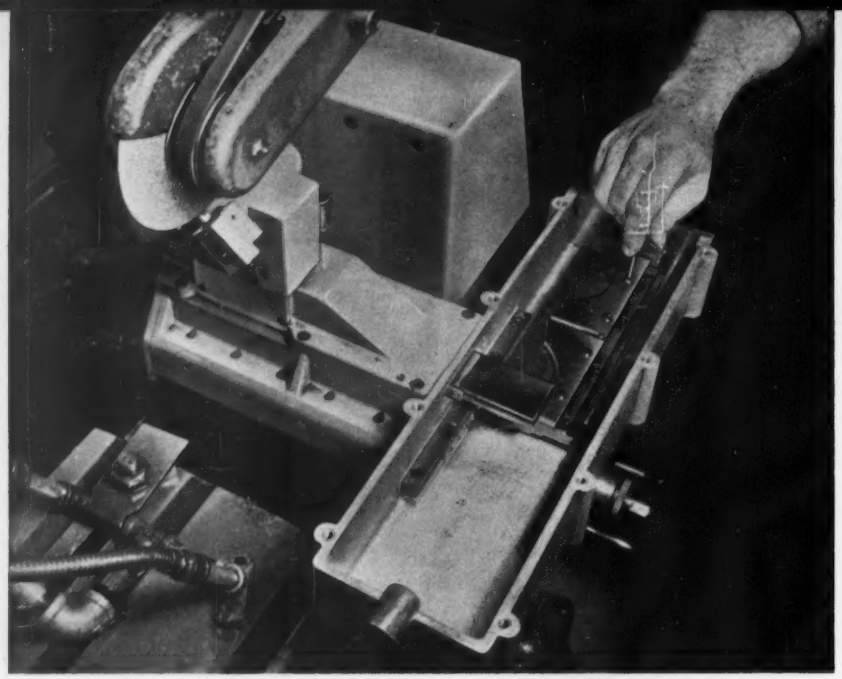


Fig. 6. Cover of dresser has been removed to change contour templates which control the form generated on the grinding wheel.

be applied to the diamonds during dressing, thus increasing the life of the diamonds.

In setting the unit up for dressing, the diamonds are centralized with relation to the grinding wheel by manually moving main slide *L* with a graduated screw *S*. Also, the diamonds are elevated to the proper height for the wheel to be dressed by rotating hand screw *T*. The dresser is equipped with a two-way, metering control valve that is connected to the standard hydraulic system of the gear grinding machine. Unskilled personnel can be used to set up and operate the simple dresser. Set-ups can be made in thirty minutes or less.

By providing two contour templates with a gap between them, adjustment can be made to extend the form for slight corrections in size to modify the profile. Adjustment consists of spreading the templates apart by inserting shims between the templates and dowel *U*, which is 0.1875 inch in diameter.

The two dressing diamonds are pre-set in their common holder prior to mounting the holder on the dresser. Setting is accomplished on a Hoglund bench microscope, Fig. 4, with an American Optical lens system. The objective lens has a four times magnification and an eye-piece of ten times magnification. A circle scribed on the lens permits setting the diamonds within an accuracy of plus or minus 0.001 inch.

A spare holder with the diamonds pre-set is generally kept available for replacing the one in use on the dresser. On conventional dressers, the diamonds are set by means of a micrometer while mounted on the dresser, and one or more work-pieces have to be ground before making

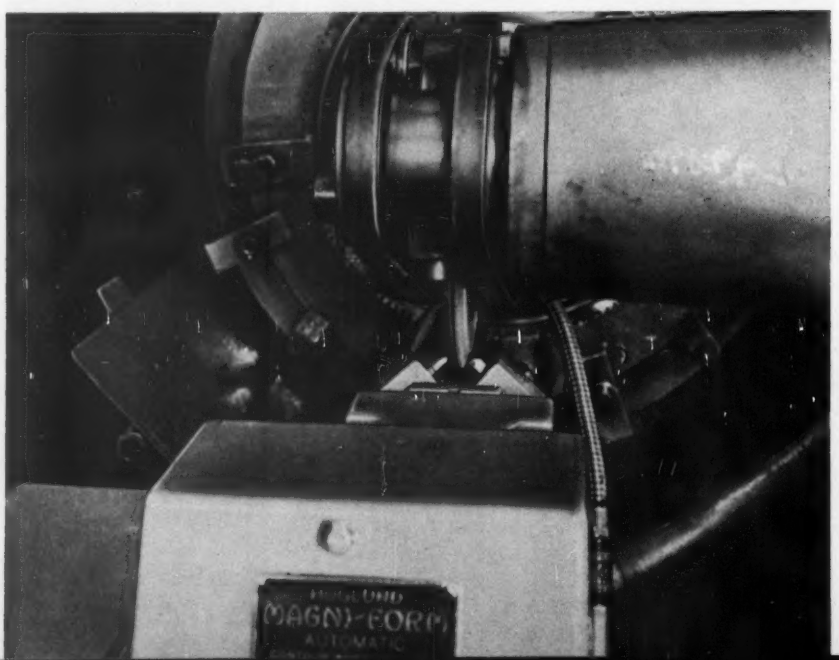


Fig. 7. Close-up view of automatic dressing operation that produces true involute forms and perfectly blended rounded corners on grinding wheels.

certain that the abrasive wheel is properly dressed. With the Magni-Form dresser, however, no further setting is required, set-up time is reduced, and scrap pieces need not be produced to insure that the wheel is dressed properly. The diamonds can be interchanged, from side to side in the holder, without affecting the accuracy of the dresser.

One of these dressers is shown in Fig. 5 mounted on a Geargrind machine in the Chicago, Ill., plant of the Foote Bros. Gear & Machine Corporation. The part being ground, made from Aeronautical Material Specification 6260 steel, is a reduction drive gear for a radial aircraft engine. The gear has a seventy-six-tooth internal spline of 12/14 diametral pitch and 20 degrees pressure angle. Chordal pitch spacing of the internal splines is 0.1338 inch; the circular pitch, 0.2618 inch; and the pitch diameter, 6.3333 inches. Contour templates, shown being mounted on the dresser in Fig. 6, produce perfectly blended rounded corners of 0.025-inch radius on the abrasive wheel being dressed. Also, a true involute form is dressed on each side of the spline grinding wheel, maintaining a tolerance of plus or minus 0.0003 inch at the involute tip. A close-up view from one end of the machine, showing the automatic dressing operation performed on this particular abrasive wheel, is illustrated in Fig. 7.

External teeth on the same reduction drive gear are ground two at a time by mounting the aircraft engine gears on an arbor. There are 144 external teeth on each gear, having a diametral pitch of 11.4286 inches and a 20-degree pressure angle. The pitch diameter of the external teeth is 12.600 inches; chordal pitch, 0.0422 inch; and circular pitch, 0.2749 inch. The design of many aircraft gears requires that the tooth surface be distorted from a true involute form. On the external teeth of this particular gear, it is necessary to hold the true involute form to plus 0.0000, minus 0.0006 at the tip, and to plus or minus 0.0003 inch on the remainder of the surface. The method employed by the Hoglund Engineering Co. in producing contour templates for the dresser permits making this or any other desired modification to the true involute form.

From 0.005 to 0.010 inch of abrasive is removed from the wheel per dressing, and about four or five dressings—three or four roughing and one finishing—are required before the reduction drive gear is ground to size. Compensation is made for the amount of abrasive removed from the periphery of the wheel by lowering the machine slide on which the grinding wheel is mounted.

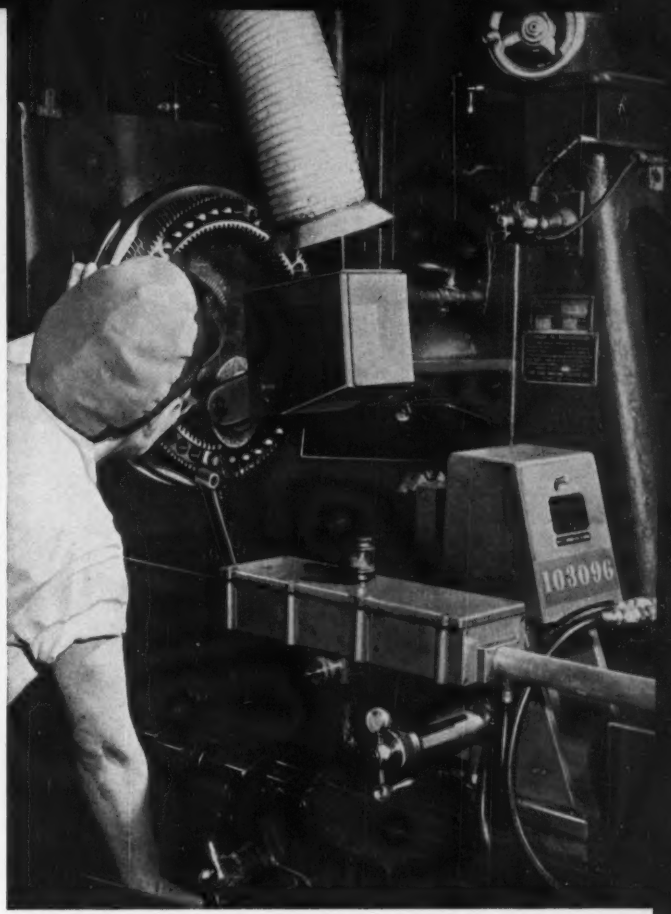
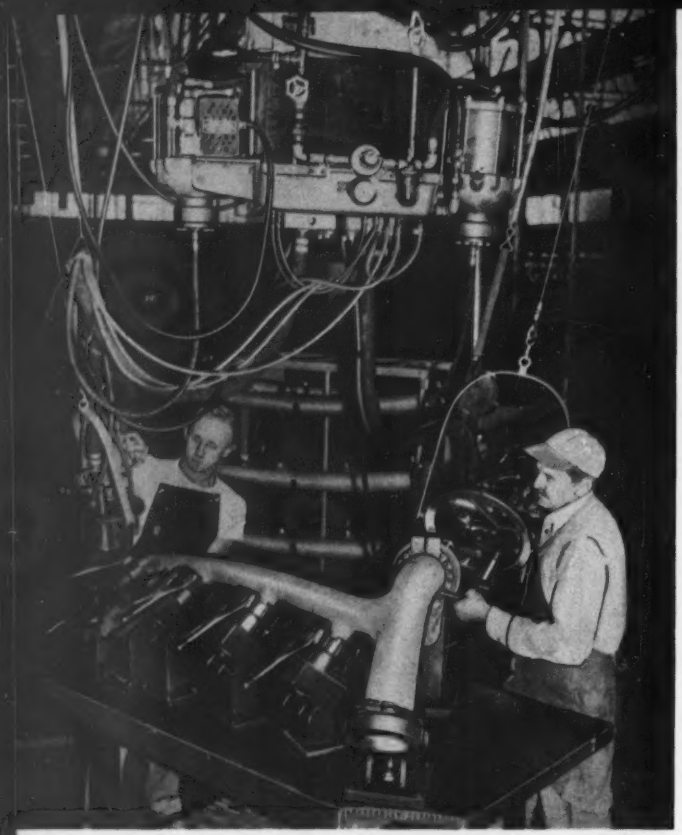


Fig. 8. Internal teeth are being ground on this large ring gear for an aircraft engine. The Magni-Form grinding wheel dresser is operated from hydraulic system of grinding machine.

Vitrified-bond, aluminum-oxide abrasive wheels of 80 grain size are employed for this gear grinding operation. A 6-inch diameter wheel is used for grinding the internal splines, while an 8-inch wheel is employed for the external teeth of the reduction drive gear. In previous methods of dressing, grinding wheel size was limited to 6 inches in diameter. Now, with the Magni-Form dresser, wheels up to 14 inches in diameter can be used on this machine. One pair of diamonds generally lasts from three to four weeks. Then, when they become worn, the diamonds can be relapped. A holder equipped with two old diamonds is employed for rough-dressing a new abrasive wheel.

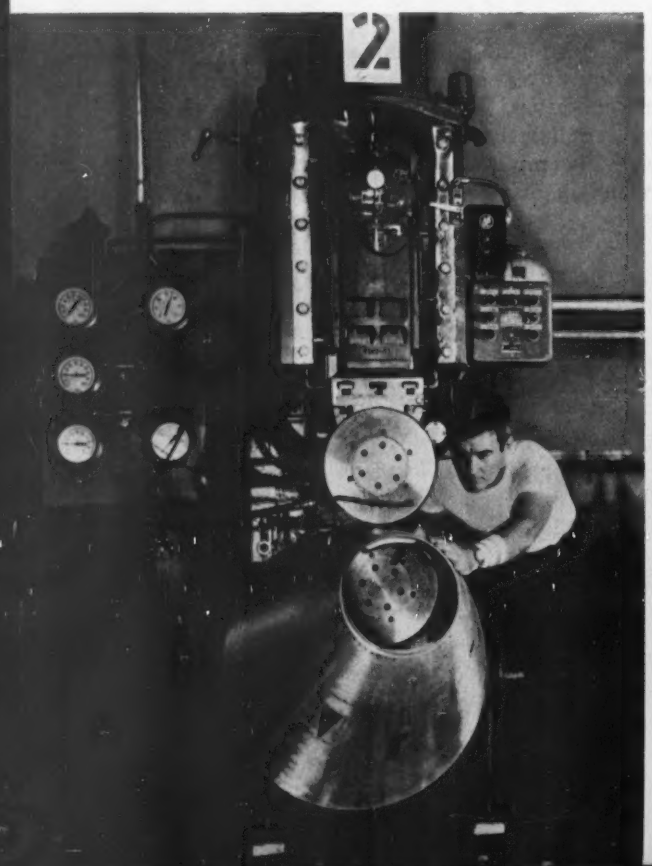
Another application of the dresser is shown in Fig. 8. This set-up, in the East Hartford, Conn., plant of Pratt & Whitney Aircraft, is employed for grinding the internal teeth on a large aircraft engine ring gear. In addition to forming wheels for grinding involute and modified involute gears and splines, the dresser is used for shaping wheels to grind special cams and threads, multiple threads, and many other different forms.

Resistance

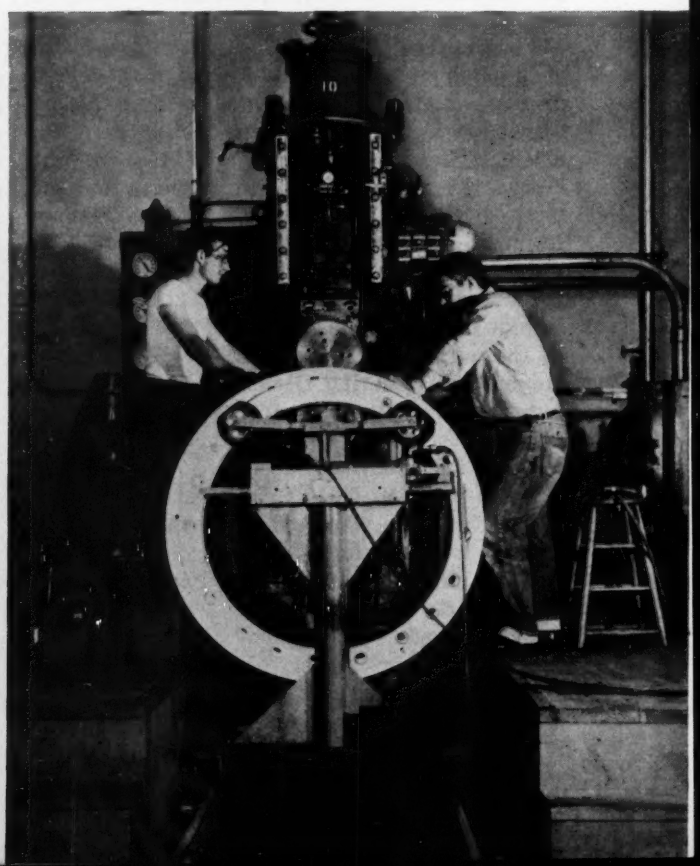


Twin guns are employed to spot-weld fittings, brackets, flanges, and hangers on manifolds for the exhaust systems of Pratt & Whitney reciprocating engines. The guns are suspended from reels carried on a monorail. Cables transmitting power to the guns are water-cooled.

Conical nose sections for a large external aircraft fuel tank being seam-welded between the wheel electrodes of this machine. The joints of the tank are made up of two spot-welded rows and a seam-welded row, and are gastight without the use of any sealing compounds.

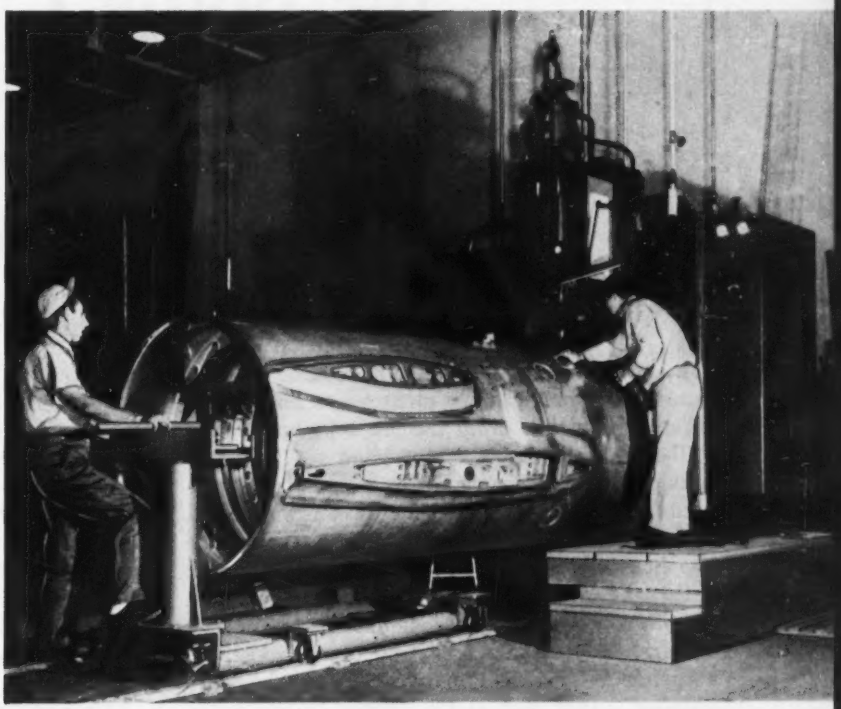


Fuel tank sections are transported to the machine and supported for seam-welding on a track conveyor. During welding, the work is free to rotate on two rollers at top of conveyor. The machine fires 120,000 amperes and exerts 11,300 pounds of pressure between electrodes.

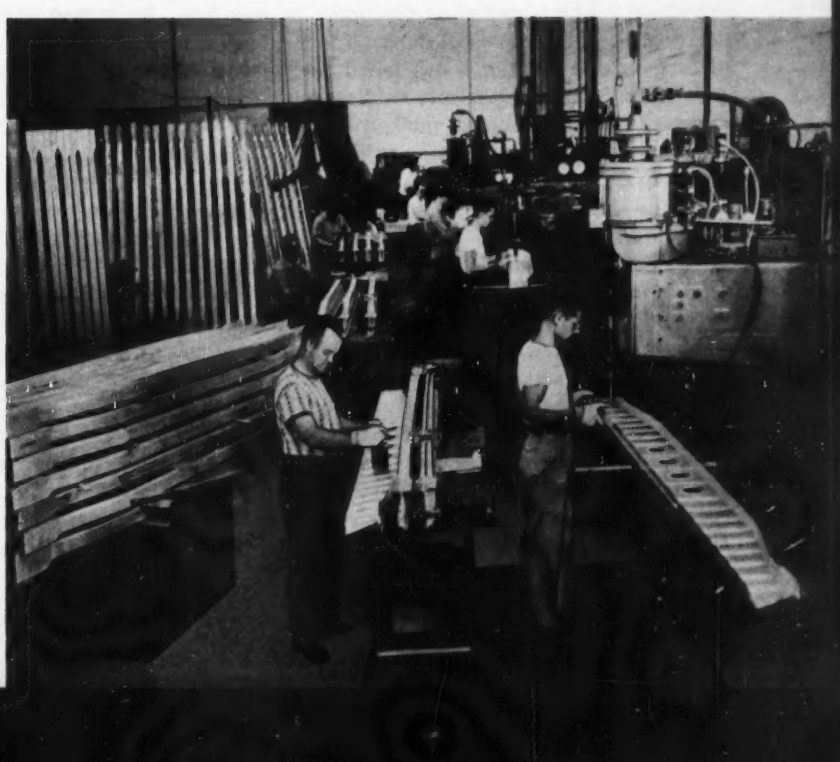


Welding in Aircraft Production

Seventy Modern Electric Spot- and Seam-Welding Machines at the Ryan Aeronautical Co., San Diego, Calif., Help Make the Company an Important Fabricating Plant in the Aircraft Industry. Here are Graphic Examples of Five Typical Welding Operations



This huge machine, one of eight installed, is shown seam-welding a large external fuel tank, part of the equipment for a Boeing B-47B Stratojet. For welding a longitudinal seam on the tanks, the wheel electrodes can be turned 90 degrees.



Floor beams for Boeing C-97 Stratofreighters are fabricated on this bank of spot-welding machines. The forty-nine beams of each plane can carry 68,000 pounds of cargo. Made of lightweight aluminum alloy, each beam has more than 1000 spot welds.

Designing Hopper Feeds for Bottle Caps

Second of Six Articles Describing Mechanisms that Automatically Feed a Continuous Line of Bottle Caps from a Hopper to Production Machines

By JOSEPH and VINCENT WAITKUS

THE so-called "double-disc rectifying hopper" shown in the illustration on the opposite page is designed to feed bottle caps to automatic machines. It operates on an entirely different principle from the pin type hopper described in June MACHINERY, page 180. In this double-disc type, the two discs *E* and *F* are fastened to the shaft *G* and kept in continual rotation in their housings *A* and *B*, respectively. The two housings are separated by four spacers *C*. A thrust bearing *H* is provided to give easy and smooth rotation. Each disc is provided with four drivers, each driver consisting of a plunger *O*, a spring *K*, and the split washer forced on the plunger. This unit of the hopper is supported on the column *D*.

As the caps fall on the disc *E*, they are thrown by centrifugal force to the inner side of the housing where they finally take a vertical position. The drivers then push the caps to the slot *I*, through which they are guided to the rectifying chute *L*. This chute is provided with two ribs which direct the caps facing one way down the chute *M*. The caps facing the opposite way fall on disc *F*. Therefore, all the caps falling on disc *F* are in one position; and when the operation of placing these caps in a vertical plane is repeated (the caps being pushed into chute *N*), they are in the same position as those caps which passed down chute *M*.

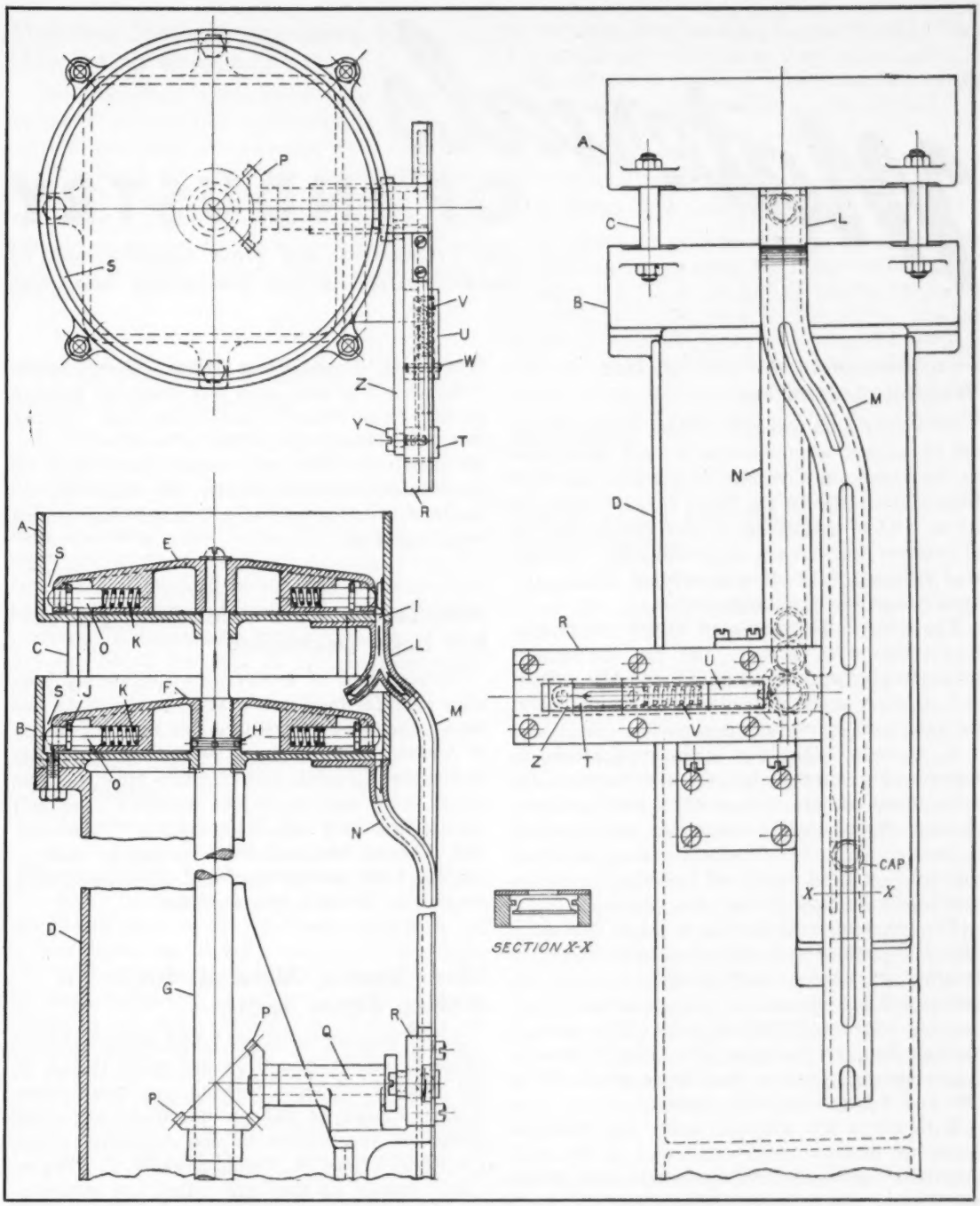
Thus there are two lines of caps which must be combined to form one line for feeding the machine below. This is accomplished by a pusher mechanism operated through a pair of bevel gears *P* from the main shaft *G*. The mechanism consists of a shaft *Q* provided with an eccentric plate which operates the driving slide *T* through the connecting bar *Z* pivoted on stud *Y*. A sliding chamber *R* is provided for the driving slide and push-plate *U*. These two parts have a flexible connection consisting of a pin *W* forced into plate *U*, which is free to operate in a slot provided in the driving slide, and a light compression spring *V*. This entire mechanism is supported on the bracket which also supports the rotating shaft *Q*.

The operation of the mechanism needs little explanation. When the chute *M* is full of caps to a point above the opening from chute *N*, the caps should not be fed from *N* to *M*. This is controlled through the compression of spring *V* by the driving slide *T* due to the resistance encountered in trying to push caps from *N* to *M*. As soon as there is an opening in chute *M*, the spring *V* expands and the full length of the driving slide and push-plate becomes effective, pushing caps from *N* to *M*.

This hopper arrangement is provided with a safety slot identical to the one provided in the pin type hopper feed previously described. This slot is even more necessary in the double-disc rectifying hopper here described because of the greater possibility of caps passing into chute *M* in the wrong position.

The main advantage of this arrangement is the elimination, to a great extent, of the churning action and subsequent scratching of the caps experienced with the feed described in the first article. It was soon learned, however, that scratching and distortion of the caps were not entirely eliminated. For example, when the chutes *M* and *N* were filled to capacity, the caps were confined to space *S*, where the lithographing on the caps might be scratched by repeated contact with the drivers.

Distortion of the caps was also experienced at the pusher mechanism due to continual hammering of the push-plate against the edge of the cap. If a large number of caps were thrown on disc *E*, the greater portion of them would be directed to the disc *F*. This would cause the second disc to become crowded, and even overflow, because the caps in chute *M* prevent the caps in chute *N* from entering chute *M*. Nevertheless, this design of feed served its purpose, even though it had faults that have been eliminated in some of the designs



Double-disc type of hopper for feeding bottle caps to cap making or bottling machines. Caps falling from disc (E) into chute (L) which are facing the desired way, fall into chute (M). Caps facing the opposite way fall on disc (F), and their positions are reversed before they enter chute (N)

to be described in forthcoming issues. The "quarter-turn chute rectifying hopper" that will be described in the next article in this series has been widely applied and is considered to be quite an improvement over the type described in this and the preceding article.

Boring Machine Shipments Increase

Shipments of boring machines during 1951 totaled 2518 machines valued at $75,100,000, representing an increase of 155 per cent in value over those shipped in 1950.

Materials OF INDUSTRY

The Properties and New Applications of Materials Used in the Mechanical Industries

Two Aluminum Alloys for Use in Welded Assemblies

Two corrosion-resistant alloys designed for use in welded assemblies have been introduced by the Aluminum Company of America, 801 Gulf Bldg., Pittsburgh 19, Pa. These alloys, designated Alcoa XA54S and Alcoa XC56S, permit the use of section thicknesses approximately one-half that required with other aluminum alloys commonly used for similar purposes.

The alloy XA54S belongs to the aluminum-magnesium alloy family, and has mechanical properties between those of 52S and 56S. Sheet and plate are available in the annealed and intermediate work-hardened tempers.

It is well suited for such applications as welded ship superstructures and barges; for such items as pressure vessels and heat exchanger shells, used in connection with tonnage oxygen plants and the manufacture of fertilizer solutions; and for liquid and bulk hauling equipment such as tank trucks and trailers.

The other alloy is similar to Alcoa 56S alloy except that the composition has been altered to improve its welding characteristics. It is recommended for general use in the annealed (–O) and hot rolled (–H112) tempers. This alloy is suitable for various types of welded structures where strengths higher than those obtainable in 52S and XA54S alloys are required.

Both alloys are weldable using the inert-gas metal-arc process (argon tungsten) or the semi-automatic inert-gas metal-arc process. The welds are ductile and have high elongation.

Cleaner Facilitates Deep-Drawing and Extrusion of Steel

A compound intended especially for use as a precleaner for steel that is to be deep-drawn or extruded has been brought out by the Detrex Corporation, Box 501, Detroit 32, Mich. The compound, Detrex 61, is used in a soak tank at approximately 190 degrees F. at a concentration from 6 to 10 ounces per gallon. It completely removes oil, grease, and dirt from all ferrous parts. In addition to possessing high wetting and penetrating properties, it is free-rinsing. The compound does not contain fatty acids or resin soaps and, consequently, any entrained solution will not be left with scummy deposits on work surfaces.

High-Temperature Alloy-Saving Steel has been Developed

Development of a ferritic or relatively low-alloy steel for high-temperature applications has been announced by the Crucible Steel Company of America, 405 Lexington Ave., New York City. Designated Crucible 422, this new steel contains about 13 per cent chromium, less than 1 per cent nickel, and only small amounts of vanadium, molybdenum, and tungsten. It can be used in making bolts for turbines and other equipment subject to elevated temperatures.

Silver Brazing Materials for Making Better Joints

Silver brazing materials which produce better joints by eliminating voids and oxide islands in the joining of most ferrous and non-ferrous metals, similar as well as dissimilar, are being placed on the market by the American Silver Co., 36-07 Prince St., Flushing 54, N. Y. "Braze-Clad" metals, as they are called, are combinations of various base metals (ferrous and non-ferrous) clad with a predetermined thickness of silver brazing alloy on one or both sides. In use, the base metal "anchors" the silver brazing alloy in place throughout the heating cycle. The alloy flows, but does not run. Typical applications include joints of large area, pressure-tight joints in high-pressure pipe lines, and blind joints. The metals are also used for joining powdered metal parts, for honeycomb structures, and for joints of very high strength.

Stainless Steel in Powdered Form Now being Produced

The production of prealloyed stainless steel in powder form has been announced by the Vanadium-Alloys Steel Co., Latrobe, Pa. A variety of prealloyed stainless-steel powder compositions, including AISI Types 316, 304, 302-B, and 431 is now available. Fabrication of filters, self-lubricating bushings, and water meter parts are some of the applications for these stainless-steel powders.

Dipping Process for Coating Ferrous Metals with Aluminum

A new dipping process for coating steel and other ferrous metals with aluminum has been developed by the General Motors Corporation, 1775 Broadway, New York 19, N. Y. "Aldip," as it is known, is said to be a simple method for producing a corrosion-resistant coating over ferrous metal. Products to which this process may be applied include heat exchangers, automotive mufflers, tail pipes, steel hangers, and paint rack fixtures which are used in various automobile production operations.

Water-Soluble Coolant Allows Cool Honing

A water-soluble coolant for honing has been marketed by the Pelron Corporation, 7740 W. 47th St., Lyons, Ill. The product, called "Pelron No. 560," facilitates the removal of stock and eliminates many of the customary problems involved in the use of kerosene and sulphur-base oils used with kerosene. This coolant combines the heat-dissipating qualities of water with the cleansing and anti-rust qualities of kerosene. It contains a high percentage of liquid detergent, an extreme-pressure agent, and a rust preventive; and is used in concentrations as low as 20 to 1, depending on the requirements for the individual application.

Spray and Dip Type Rust Inhibitor for Machined Parts

An animal fat base rust inhibitor that has some lubrication qualities has been developed by Crown Industrial Products Co., Park and Borden Aves., Sycamore, Ill. The Crown rust inhibitor will withstand normal handling, and is non-toxic and non-inflammable. It can be applied to wet, damp, or moist surfaces and still be effective. When applied to precision or friction parts, there is no tendency to gum or clog. This product is offered in spray containers, but it is also available in the usual bulk quantities where production-line dip methods are to be used.

Electrocleaning Material for Zinc-Base Die-Castings

Zinc-base die-castings can be electrolytically conditioned for plating by using Oakite Composition No. 95, a product of Oakite Products, Inc., 126 Rector St., New York 6, N. Y. The use of this composition prior to plating die-castings removes surface films, disturbed metal, and traces of soil, which are among the major causes of peeling, blistering, and dulling of subsequent electroplates.

Plastic Fillets for Use in Patternmaking

A plastic fillet intended for use in making patterns was recently announced by the Kindt-Collins Co., 12653 Elmwood Ave., Cleveland 11, Ohio.

Major features of this new product, which is called the "Master Universal Fillet," are ease of application and wearability. Finger-tip pressure or use of a fillet tool is all that is required to attach the fillet permanently to wood or metal patterns and core-boxes. The fillet will conform to almost any shape or surface normally encountered in patternmaking.

It is impervious to moisture, core oils, and liquid partings, and can be coated with shellac, lacquer, or any recognized pattern coating. The manufacturer states that it is durable, does not dry out, maintains its dimensions under all conditions of temperature normally encountered in foundry practice, and will remain permanently in place. A special waterproof cement available from the manufacturer is required to apply these plastic fillets.

Cold Galvanizing Process for Surface Protection

A new method for cold galvanizing the surface of steel and iron has been devised by the Galvanite Corporation, 40 W. 29th St., New York 1, N. Y. The process utilizes "Galvanite," which is not a paint but a cold galvanizing compound. This compound may be applied with paint brush, electric spray gun, or by cold dip.

Within forty minutes after application it will be tack-free, and within forty-eight hours will be completely dry for use.

Hydraulic Clamping Accelerates Spar Milling

MANY prominent airframe manufacturers machine spar beams, cap strips, and other long-dimension aircraft parts on Onsrud automatic contour millers. New tooling, consisting of a series of hydraulically actuated clamps, now greatly simplifies the work-holding problem.

In Fig. 1 the new tooling is represented diagrammatically. An aluminum spar *A* to be contour-milled is set up over a cast-iron locating strip *B* keyed to a fixture base *C*, which, in turn, is bolted to the table slots *D*. Also on the fixture base is a rib *E* to which is fastened the template *F* used for the operation. Rising through the lattice-like body of the fixture base and close to each side of the spar is a series of clamping bushings *G*, arranged in pairs. Jaws *H* on shafts contained in the bushings apply pressure on the top of the work.

In this kind of milling machine, the feed movement is executed by the traverse over the work of a carriage *J* having two horizontal and two vertical cutter-heads—one horizontal cutter-head *K* being illustrated. Each head has an arbor *L*, a cutter *M*, and a follower *N*. When the cutter approaches each pair of clamps, the jaw shafts automatically rise slightly and pivot 90 degrees to the position illustrated by the clamp jaws *O*. Here the top of the work is accessible to the cutter, yet the jaws can still clear the bottom of the arbor. Once the carriage has passed by the clamps, they automatically return to their initial position.

The clamps are energized from a hydraulic pump and reservoir (not shown). Pressurized oil is directed by solenoids *P* and valves *Q* along the front apron of the machine through piping *R* leading to cylinders *S* located in the bed between each pair of clamps. A piston *T* and a cross-bar *U* link the cylinders to the jaw shafts. The hydraulic system can be manually operated from a push-button panel *V*.

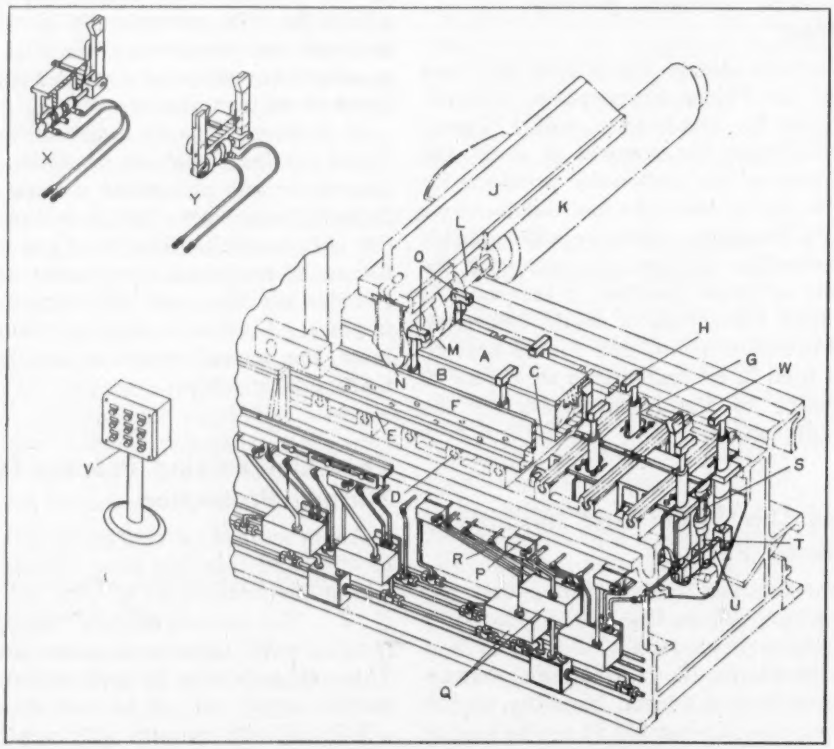


Fig. 1. In this clamping system the position of the jaws (H) is automatically changed to that of the jaws (O) as the cutter approaches.

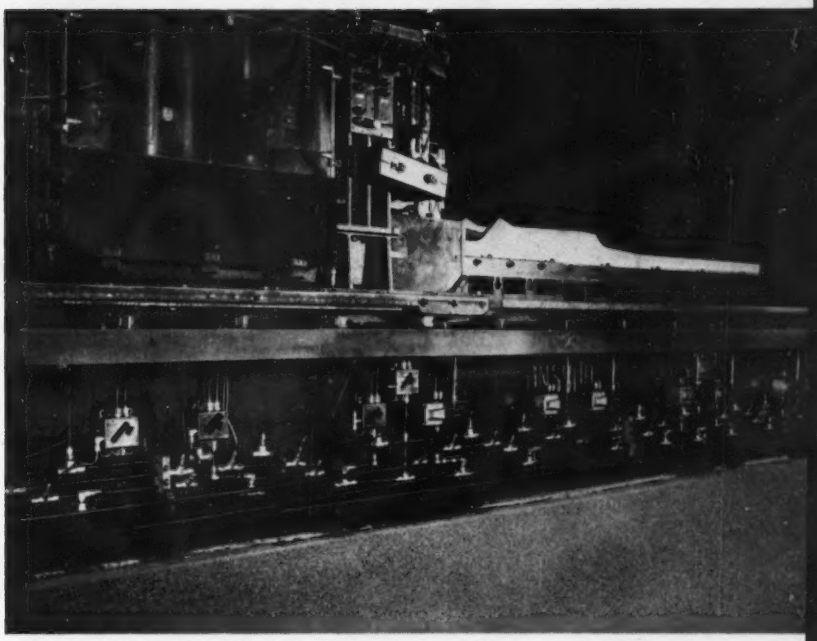
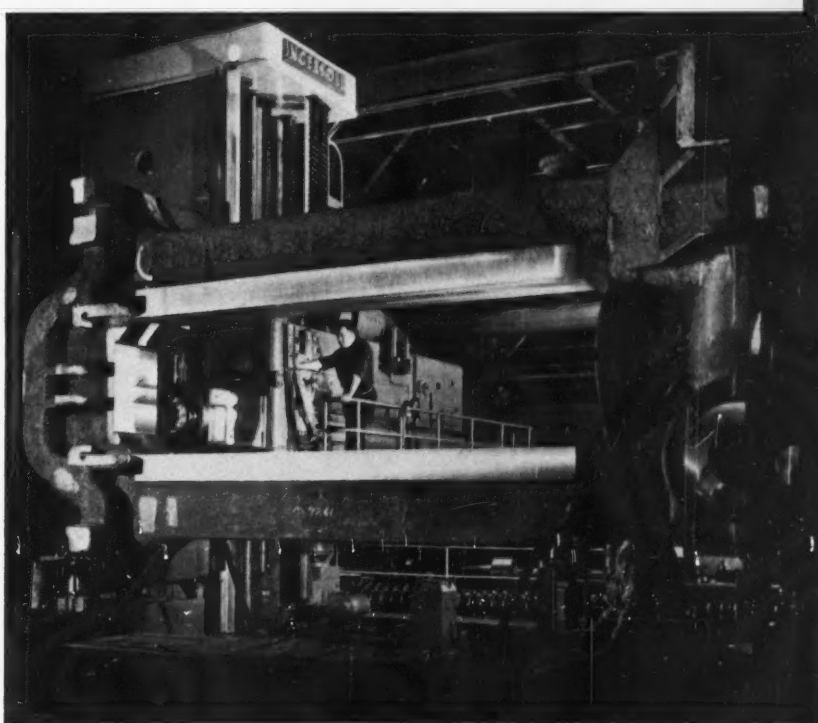


Fig. 2. The piping for the hydraulic system is arranged along the side of the bed on the automatic contour milling machine here shown.

In addition to the type of clamps described, which apply a downward pressure, other clamps *W* can apply a sideward pressure. Two styles of such clamps are shown separately at *X* and *Y*. Style *X* has a single jaw, and applies pressure against only one side of an object. Style *Y* has two opposing jaws, and applies pressure against two sides of an object.

A shop view of the elaborate piping of the hydraulic system is shown in Fig. 2. This particular installation is at the Temco Aircraft Corporation, Dallas, Tex.

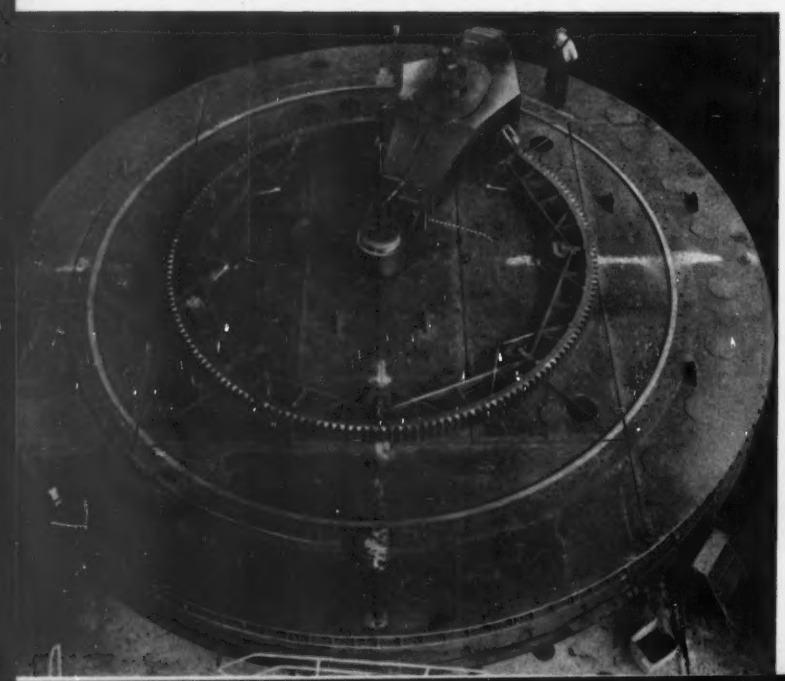


Mammoth milling and boring machine, weighing over 200 tons, in operation at the Lewis Foundry & Machine Division of Blaw-Knox Co., Pittsburgh, Pa. The largest unit of its type ever built by the Ingersoll Milling Machine Co., it has a 24-inch ram that will extend 74 inches. The vertical and horizontal travel are 12 feet and 46 feet, respectively. This installation is being used for producing large rolling mill equipment, such as the four-high mill illustrated.

In Shops Around the

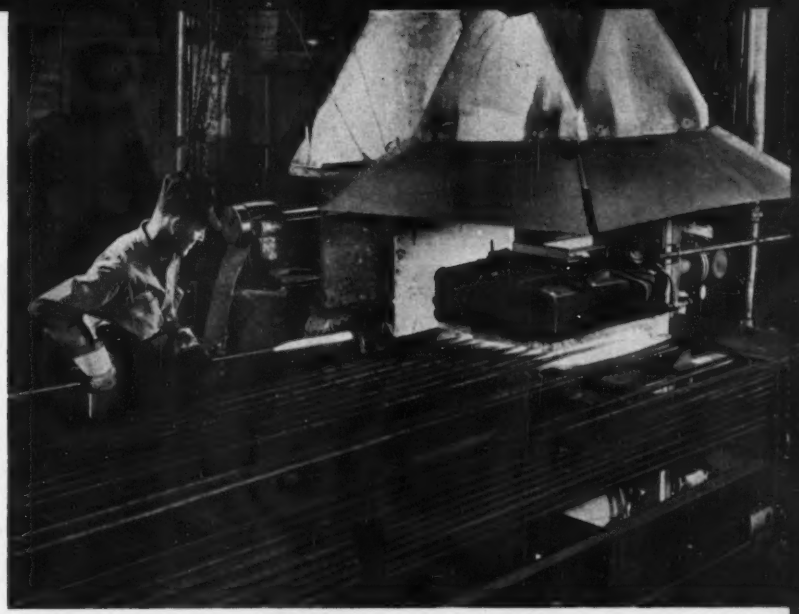
Camera Highlights of Some Interesting Operations Performed in Various Metal-Working Plants throughout the Nation

A pair of rugged two-unit boring fixtures on these radial drilling machines save man-hours for the Ryan Aeronautical Co., San Diego, Calif. The fixtures, on the American Tool Works radial drilling machine (foreground) and the Cincinnati Gilbert radial drilling machine (background), are used to bore, turn, face, and undercut aft-frame flanges which support combustion chambers of General Electric J-47 jet engines. Head unit supports multiple cutter and is driven and fed from spindle of drilling machine; work unit holds flange and rotates on ball bearings to permit easy and accurate indexing.

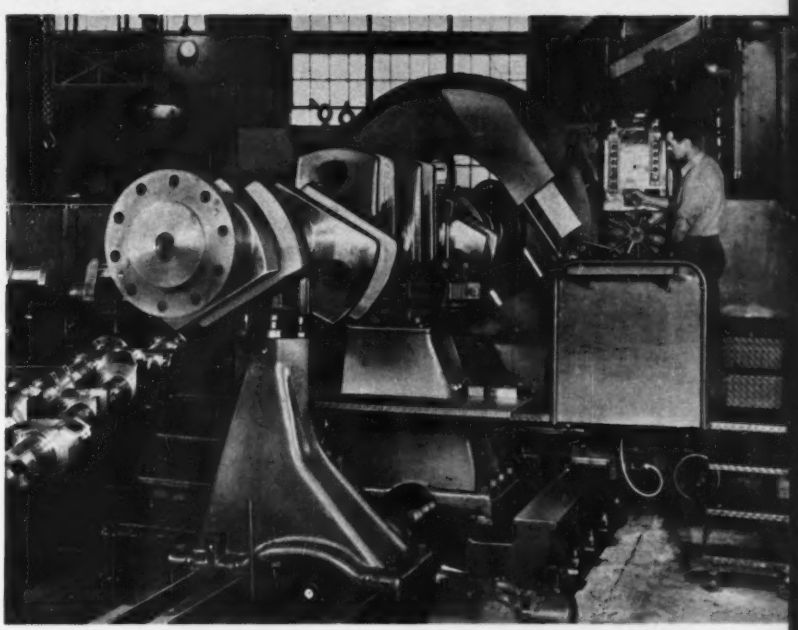


Base for a 1500-ton Bucyrus-Erie "walking" dragline excavator being machined in the field. Too big to be shipped in one piece, the base structure consists of a series of weldments. The portable planer, weighing 10 tons, is pivoted from the center pintle of the base, rolls on the shoulder of the big gear, and is electrically driven through a pinion engaged to the gear. One of the largest machines able to move over land under its own power, the dragline travels on two 44-ton shoes, can dig with a 30-cubic yard bucket from a pit 120 feet below its level, and can swing around and dump its load on the top of an eight-story building.

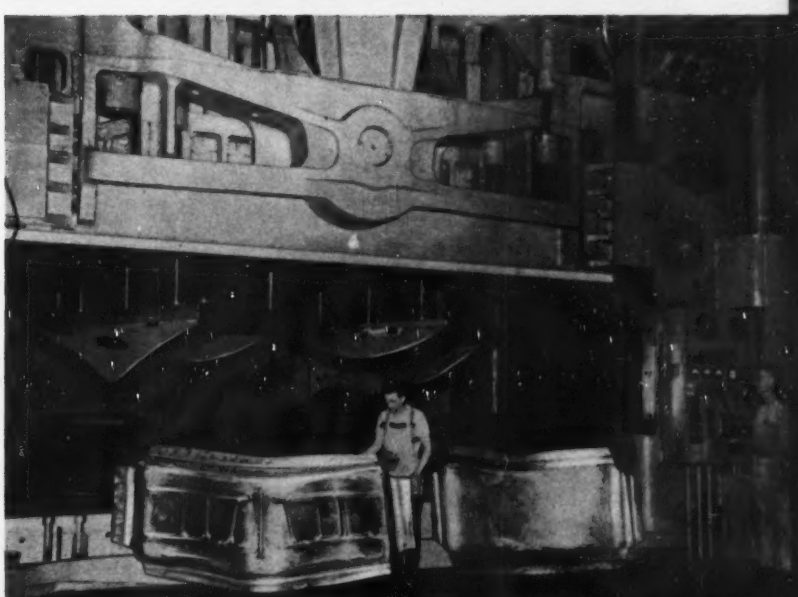
Country



New split side wall heating chamber with gas-fired line burners makes quick work of bringing sucker rods used in the oil-well industry up to forging heat. Vertical downward firing onto a refractory bed replaces conventional side wall and side burner design, permitting through travel of the bars. Four of these furnaces, made by the Surface Combustion Corporation, Toledo, Ohio, have been installed at the S. M. Jones Co. located in the same city.

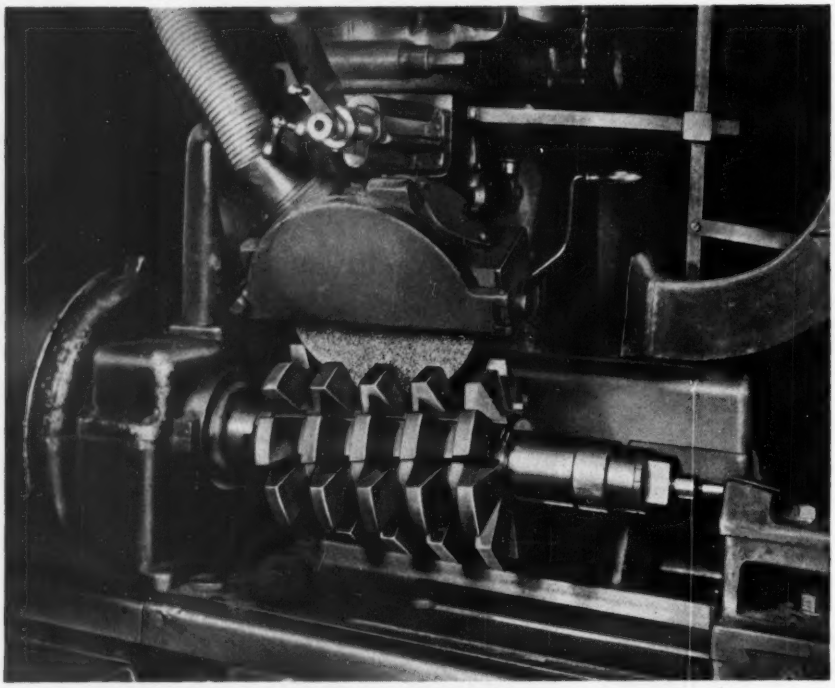


Crankshafts for 5000-H.P. engines are machined on this special lathe installed at the Grove City, Pa., plant of Cooper-Bessemer Corporation. Built by the Wickes Corporation, Saginaw, Mich., the lathe is unusual in that the work remains stationary and the cutter revolves. A large ring-shaped head carries the cutter, enclosing the 7-ton crankshaft, and feeds over bed. The work being stationary, counterweighing is unnecessary.



Plastic dies were chosen for the initial test run of one of the largest triple-action draw presses in the world. Illustrated is an 8000-ton Birdsboro hydraulic press in operation at the Burbank, Calif., plant of the Lockheed Aircraft Corporation. It is tooled with two Rezolin dies, simultaneously drawing outer and inner panels of a large door. Press makes possible the one-piece design of large heavy-gage aluminum-alloy parts previously made in several riveted sections.

Hobbing Accurate Gears



By STUART J. JOHNSON, Hob Engineer, and
PETER R. NOLING, Machine Tool Engineer
Barber-Colman Co.

HOBBING techniques have been developed by which it is now possible to finish gears to accuracies hitherto not attainable by hobbing. One result is that some of the finest precision instruments such as gun-firing, fire-control, and timing mechanisms contain gears which are finished by hobbing.

The accuracy of a gear depends to a great extent upon the accuracy of the hob. To aid in choosing a hob which will meet the requirements of a job, the Metal Cutting Tool Institute adopted four standard classifications as follows: Class A, precision ground; Class B, commercial ground; Class C, accurate unground; and Class D, commercial unground.

The Barber-Colman Co., Rockford, Ill., makes hobs in all of these classes and, in addition, produces a Class AA ultra precision-ground hob for work of utmost accuracy. Although all commercial hobs come within the standard tolerances for each class, some hobs will cut gears more accurately than others. Therefore, when both a gear and a pinion are to be cut, the best hobs should be selected from stock for cutting the pinions and the other hobs used for the gears. The best hobs are generally determined by cutting a pinion with each hob.

Inaccuracies in a hob primarily affect the profile of the gear tooth, and profile errors will produce non-uniform motion. The main characteristic of the involute curve on gear teeth is the transfer of a constant angular velocity to the mating gear. This is, however, a characteristic only of a true involute curve; therefore a hob of the best class should be used if constant angular velocity is of primary importance.

Reducing Hob Run-Out

Run-out can destroy most of the inherent accuracy of a hob, and must be carefully controlled if precision gears are to be produced. One of the easiest methods of reducing hob run-out is by using hobs with taper bores or taper shanks. The hob run-out in any precision hobbing operation should not exceed 0.0002 inch. It is difficult

to hold a straight-hole hob to this tolerance. Even if the hob is trued properly to start, the intermittent cutting pressure may increase the run-out during cutting.

On taper-hole hobs for gears of 6 diametral pitch or finer, the hole is held within 0.0001 inch in relation to the hub diameter. Thus with the metal-to-metal contact between the hob and the arbor, it is usually a simple matter to hold run-out within 0.0002 inch. Also, a great deal of time is saved by the operator because he can "true-up" the hob easily. Hob run-out cannot increase during the cutting operation because of the metal-to-metal contact.

If the accuracy requirements of the gear indicate the necessity of using a Class AA or a Class A hob, Barber-Colman engineers nearly always recommend a taper-hole hob. Hobs of this type are also often recommended in the case of Class B and Class C hobs because of the added rigidity, particularly for multiple-thread hobs of large diameter.

A taper-hole hob is usually made larger than a corresponding straight-hole hob because the large end of the taper hole is of greater diameter than the straight hole. Consequently, the taper-hole hob is somewhat more expensive. On the other hand, the increased number of teeth means greater life for the hob and a better finish on the gear teeth.

When shank hobs are necessary, they may be made with either straight or tapered shanks. For maximum accuracy, some manufacturers supply hobs with tapered shanks on both ends. The hob is ground true with the shank, thus eliminating errors which sometimes occur in mounting shell type hobs on arbors. Inspection of a 32 diametral pitch pinion cut with a Class AA hob having two tapered shanks showed a tooth-to-tooth composite error of only 0.0002 to 0.0004 inch—or about one-half the composite error obtained by the method previously employed. Special slides are available to accommodate taper-shank hobs.

Accurate Blanks are Essential for Accurate Gears

Gear blanks must be properly designed and correctly machined prior to hobbing in order to obtain satisfactory gears. The hole in a gear should be large enough to adequately support the blank during the hobbing operation, but it should not be so large as to cause distortion. In machining gear blanks, the faces must be ground accurately in relation to the hole in order to reduce run-out and distortion to a minimum. Blanks integral with a shaft should have the shaft strong enough to prevent deflection during hobbing.

Excessive run-out may cause tooth interference on gears which are not "topped." When close backlash tolerance is specified, interference may develop if the high teeth come together. Run-out of the periphery of fine-pitch gears must be held proportionately closer than on coarse-pitch gears.

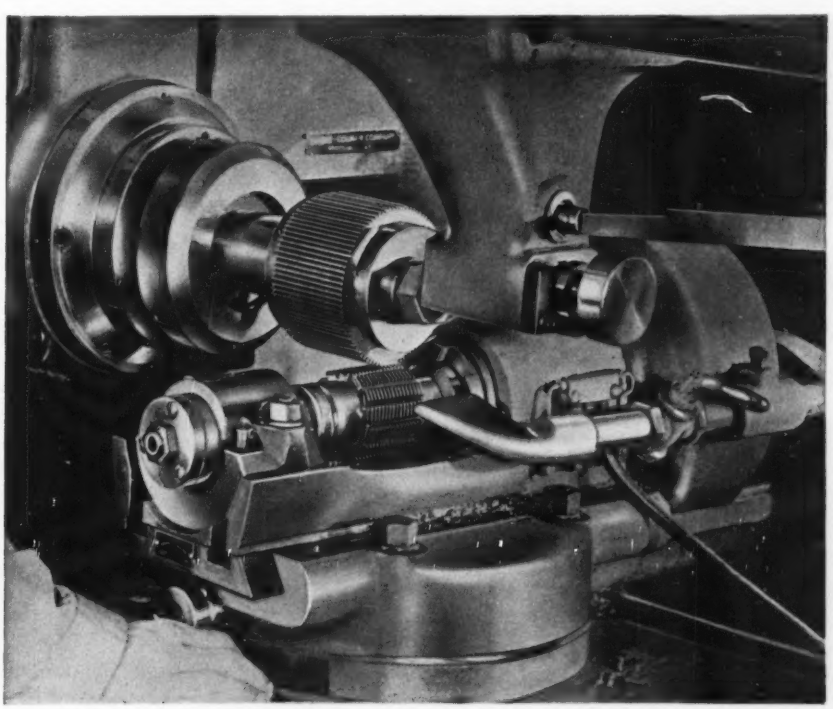


Fig. 1. Rigid tooling is required for hobbing gears. Arbors must be held solidly and they should be sturdy enough to support the work rigidly.

Hobbing Machines Must be Kept Accurate

Although the hob is blamed for poor gears in many cases, it is often the fault of the machine rather than the hob. Profile errors are frequently caused by inaccuracies in the hob or run-out of the hob on the machine. Most other errors are usually the result of machine conditions or poor tooling. Some of the machine components which affect accuracy and which should be inspected frequently include (1) the hob spindle; (2) the work-spindle; (3) the index-worm (for end thrust); (4) the worm and worm gear (for mesh); (5) the gibs on the hob swivel slide; (6) the hob drive gear and pinion; and (7) the feed-screw nut (for backlash adjustment).

Lead errors in a gear are primarily the result of machine conditions. Wear or damage which has destroyed the parallelism between the work-spindle and the movement of the hob swivel slide will affect the lead of a gear. Damage to the feed-screw or wear will cause lead errors. Many machines are now equipped with a backlash adjustment for the feed-screw nut which can be employed to take up any wear between the nut and the screw. The lead of helical gears may be affected by the accuracy of the ratios of the index and feed change-gears. Normally, the index gears are an exact ratio while the feed gears are an approximate ratio. The closer the feed gears are calculated to an exact ratio, the more accurate the lead will be in the finished product.

Hobbing between centers normally produces the most accurate gears. This method of locating offers a common reference for machining operations. The precision collet chuck is another type of holding device which has been used successfully for hobbing accurate gears. The collet chucks can be mounted in such a way as to practically eliminate the effect of any run-out between the chuck and the spindle. Of course the advantage of a precision chuck is reduced considerably if the gear blanks are not accurate to begin with.

Back-up plates add to the rigidity of a set-up and are recommended whenever it is possible to use them. They reduce the tendency of gear blanks to spring under cutting pressure. Both the back-up plates and the gear blanks must be clean to prevent the blanks from twisting. A steadyrest should be employed whenever the arbor or the shaft on which the gear is mounted is too long or too weak to keep the work from springing upward when the hob teeth cut into the blank.

Accurate Sharpening of Hobs is of Utmost Importance

Errors in sharpening a hob can produce a variety of profile errors on the gear, and hobs should be sharpened frequently so that the worn part of a tooth does not impart excessive errors to the gear. Hobs are sharpened by their manufacturers to a standard tolerance which is de-

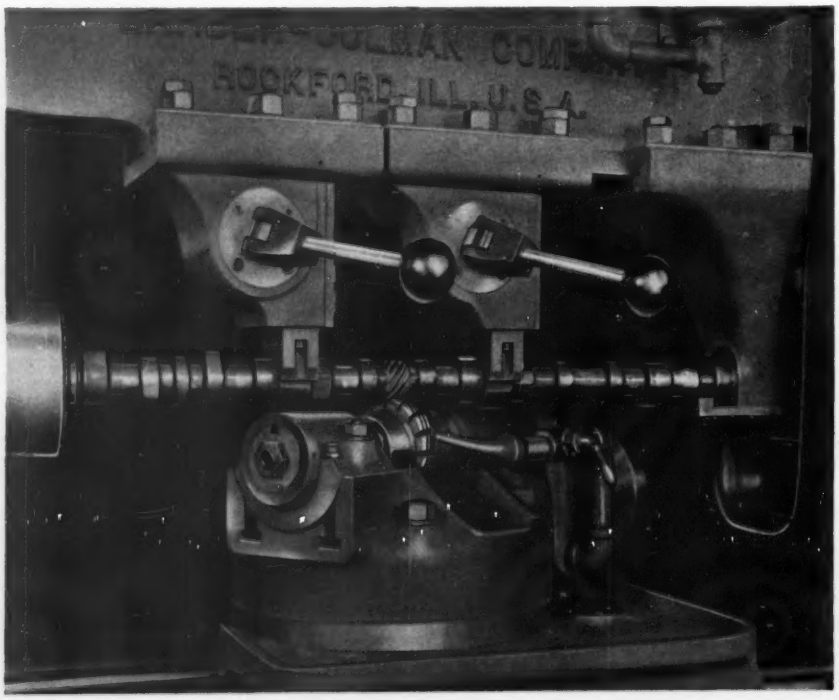


Fig. 2. Steadyrests may be used to support long slender pieces of work in the cutting area, thus eliminating any tendency for the work to spring upward under the cutting pressure.

Fig. 3. Run-out of the hob should be inspected after the hob has been mounted on the gear-hobbing machine in the manner here illustrated.

pendent upon the class. In order to maintain the original accuracy of the hob, it is important that it be kept sharp within these tolerances. Unequal spacing of cutting edges will produce peaks and valleys on a gear tooth profile, and an error in the amount of offset of cutting faces will cause errors in gear tooth profile.

Excessive errors in the lead of hob cutting faces will produce a gear tooth which leans to one side. The pressure angle on one side of the tooth will be excessive while the pressure angle on the other side will be less than standard. This type of error can be caused by misalignment of the headstock and tailstock centers, incorrect setting of the tangent bar on the machine, or failure to "spark out" properly in sharpening the hob. For precision gears it is recommended that the hobs be sharpened on a hob sharpening machine.

A precision instrument has been developed by the company for checking tooth-to-tooth spacing, accumulated spacing, and face offset for both straight- and helical-fluted hobs. Straight-fluted hobs, thread milling cutters, and form-relieved cutters can also be checked to see if the flutes are parallel with the axis. In addition to being used as an aid in sharpening, this checking instrument should be employed for final inspection of the sharpening operation to make sure that the cutting elements of the hob are within the standard tolerances for its particular size and class specifications.

Locomotive Equipped with Wheels that Move Sideways

Conventional railroad locomotives negotiate curves by the entire locomotive sliding sideways as the wheels roll forward, there being no provision for lateral movement of the wheels with respect to the locomotive frame. Now the engineers of the Westinghouse Electric Corporation have designed a gas-turbine locomotive equipped with wheels that can move from side to side with respect to the remainder of the locomotive. This design results in smoother riding.

The locomotive is powered by two 2000-H.P. gas turbines with an electric transmission. It is a single-unit locomotive with eight axles and weighs 247 tons. The locomotive has a maximum speed of 100 miles per hour, and in test runs has pulled up to twenty-nine cars at a time.

* * *

Costs Cut by Shredding Blueprints

Old blueprints are saving tax dollars at a major United States aircraft plant. Over 179 tons of discarded blueprints have been shredded into "hay" for packing shipments of close-tolerance metal parts. Ammonia in the blueprints neutralizes acid in the paper, making it ideal for packing parts subject to corrosion. An equivalent amount of specially treated acid-free paper would cost about $18,000.

Band-Sawing by Reducing

By
H. J. CHAMBERLAND
Field Engineer
DoAll Co., Des Plaines, Ill.

Fig. 1. Slugs sawed from each corner of this 18-inch thick forging die-block have the same value per pound as the original block.

MANY ingenious methods have been developed by the metal-working industry to minimize material waste when parts are produced in substantial volume. For short production runs, however, the problem of conserving material is often more difficult. When a substantial but not necessarily excessive amount of material has to be removed from a relatively small lot of parts, it is often advantageous to use band-sawing. In this way considerable material can be saved, and finishing operations, if required, simplified.

All material removed by band machining is in the form of slugs, or intact pieces. Depending on the outline or design being cut, the material substantially retains its original value. If the pieces removed are square or rectangular, their value in terms of cost per pound has not been affected in the least. Otherwise, material savings depend on the complexity of the outline of the various parts, and the purpose to which the slugs or pieces can be applied determines the actual amount of waste.

Exclusive of the material that can be saved, band-sawing can usually be performed very rapidly unless the cut is exceptionally thick and the hardness of the material makes it necessary to limit the cutting rate to obtain a favorable saw life. In this latter instance, however, material economy will generally more than compensate for reduced cutting rate.

In Fig. 1 is seen a typical example of the economy that can be obtained with band-sawing. Slugs 2 1/2 by 4 1/2 inches are removed from each corner of a molybdenum steel forging die-block 18 inches thick at the rate of one per hour. Accuracy is maintained within 0.002 inch by means of an auxiliary, mechanically fed table that is equipped with roller bearings. This and other dies of similar size were previously ma-

Fig. 2. Flats are cut on wrist-pins on a production basis with a fixture that eliminates setting up for each cut.

Saves Stock Chip Waste

Fig. 3. Slugs cut from high-carbon chromium steel discs, 3 inches thick and 12 inches in diameter, are used to make parts shown in Fig. 4.

chined at an operating cost three times that of band-sawing. More significant in this instance is the fact that all of the slugs removed retain their original value per pound.

A set-up employed for sawing flats on Diesel engine wrist-pins, 12 inches in diameter and 18 inches long, is illustrated in Fig. 2. The wrist-pins, made of 0.45 per cent carbon steel, weigh 550 pounds each. The end cuts are 4 inches deep, and the side cuts 2 1/2 inches deep. While machining of the eight flat surfaces on each wrist-pin formerly required eight hours, they are now sawed in only two hours. These parts are machined on a production basis, and are held in a fixture designed to automatically eliminate set-up time for each cut. Although the major economy with this application appears to be the substantial increase in production, the value of the slugs cannot be ignored, since this particular type of steel is ideal for numerous applications in many plants. It has been estimated that the pieces removed do not depreciate more than 50 per cent in material value. The net material savings in forty hours is about 350 pounds.

The discs shown being machined in Fig. 3 are of high-carbon chromium steel 3 inches thick, 12 inches in diameter, and weighing 96 pounds each. As with the job illustrated in Fig. 2, material economy would seem to be of minor importance if it were not for the fact that fifteen such discs per week are required. Also, the slugs removed are used to make diversified parts, such as the fittings and brackets shown in Fig. 4. A 50 per cent depreciation in the material value of these slugs is also a fair estimate. It is well to bear in mind that this steel costs approximately 63 cents per pound, and is sometimes not available because of widespread demand. In forty hours, the net material savings is 250 pounds.

Fig. 4. Fittings and brackets are sawed from slugs that have been salvaged in the band-sawing operation illustrated in Fig. 3.

New Grinding Fixtures Increase Tank Transmission Production

By JERRY B. DOLL, Superintendent
Factory No. 28, Buick Motor Division
General Motors Corporation
Flint, Mich.

INGENIOUS grinding fixtures are giving the Buick Motor Division, General Motors Corporation, substantial assistance in fulfilling its ordnance commitments. These fixtures are used in making many small parts for the "CD-850" transmission for the new Patton 48 medium tank.

Flat rings such as are shown in Fig. 1 were formerly held in a universal three-jaw chuck while the inside diameter was ground in each piece individually. The procedure proved unsatisfactory, for when sufficient radial pressure was applied to hold the work, it was distorted beyond the permissible deviation from roundness (0.001 inch). Efforts to use a pot chuck to grind the rings were unsuccessful because the rings tended to wedge in the bore of the chuck when loading and unloading.

As a result, the spider type fixture seen in Fig. 1 was designed. Each of the three segments *A* of the spider is fastened to a tapered shoe *B* that can slide radially in front of the body *C* of the fixture. In preparing the fixture, the shoes were adjusted so that the inside diameter of the spider was slightly less than the outside diameter of the rings. The inside diameter of the spider was then ground out 0.001 inch larger than the outside diameter of the rings (which diameter was previously centerless ground to exact size).

Radial closure of the segments is accurately limited. For quick loading, the segments are expanded, then closed to the grinding position. Six rings are accommodated at a time. The rings are held in place solely by pressure applied through thumb-screws *D* and clamps *E* on the face of the outermost ring. Since no radial pressure is imposed on the outside diameter of the rings, their roundness is maintained. Furthermore, since the six rings are handled simultane-

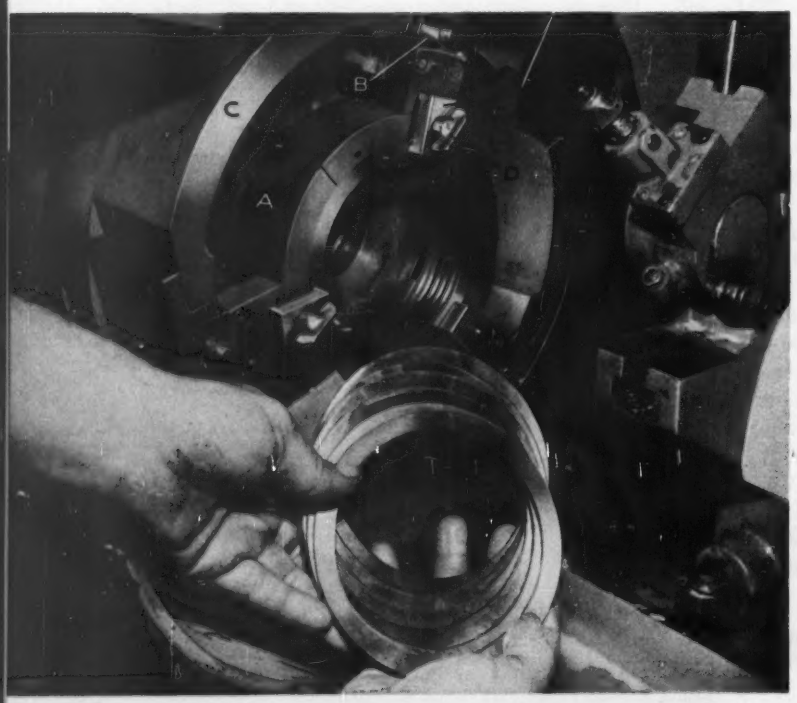
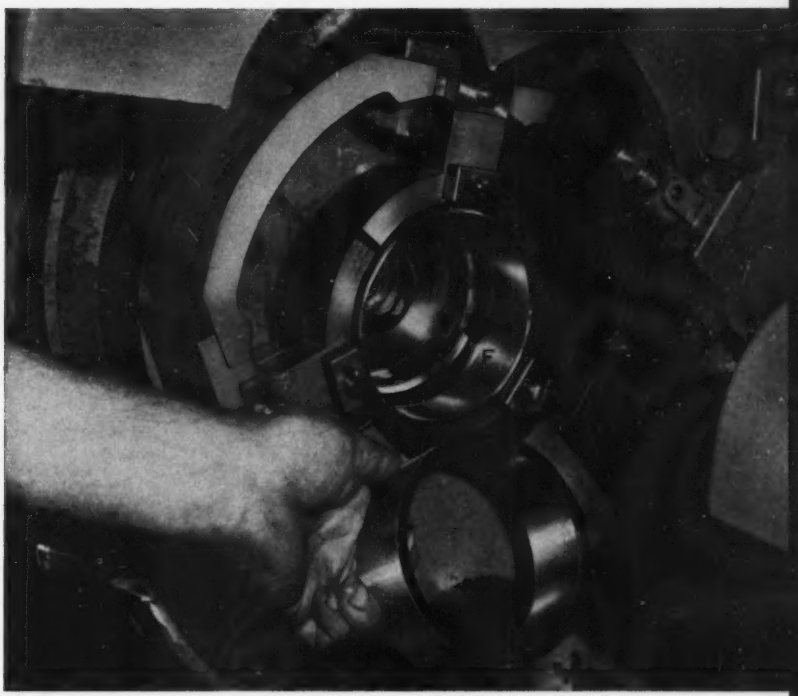


Fig. 1. Flat rings remain free from distortion when held for grinding in this spider type fixture. The segments (A) are fastened to shoes (B) that slide radially in front of the body (C).

Fig. 2. Employing one fixture to do two jobs. The fixture illustrated in Fig. 1 is here adapted for performing another grinding operation by inserting a split bushing (F).



ously, a considerable saving in time is realized over the original procedure.

To grind the inside diameter of the sleeve shown in Fig. 2, the same fixture that appears in Fig. 1 is employed. Because the outside diameter of the sleeve is smaller than that of the rings, a split bushing *F* is introduced between the segments and the sleeve. This bushing is left in place and the sleeve is slipped into the bushing, then held by the end pressure applied by means of the thumb-screws and clamps.

Another fixture was designed to hold soft steel studs having 1/4–28 threads over their full length. These studs required two flats 180 degrees apart to be ground on their diameter. It was important that the clamping arrangement used would not mar the threads. Two faceplates, opposite sides of which are illustrated in Fig. 3, were built. Each faceplate has a series of twelve square-headed plungers *G* held down by springs under washers *H*. Two circles, each consisting of twelve shoulder pads *J*, are fixed to the faceplate, adjacent to the inner and outer edges of the plungers.

The threaded studs *K* are positioned against each shoulder pad (only two are shown in position in the illustration) while the plungers are elevated. When the plungers are released, the

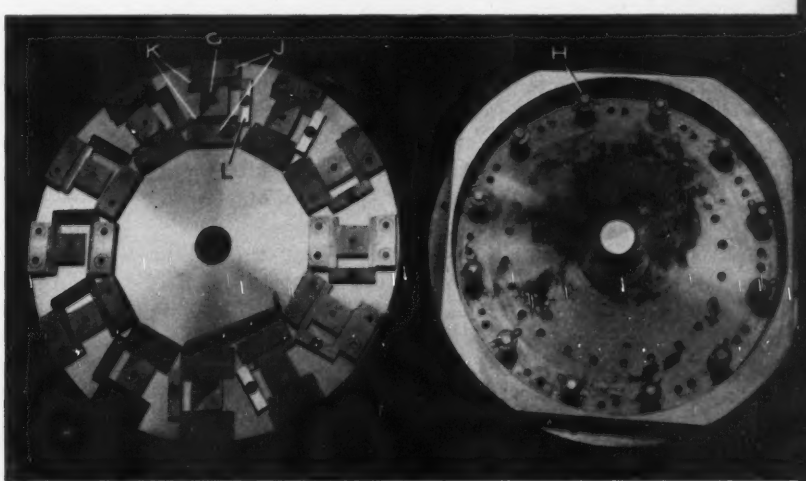


Fig. 3. Views of opposite sides of faceplates used in grinding flats on threaded studs. Spring plungers clamp the studs firmly in place without damaging threads. Back-stops absorb end thrust.

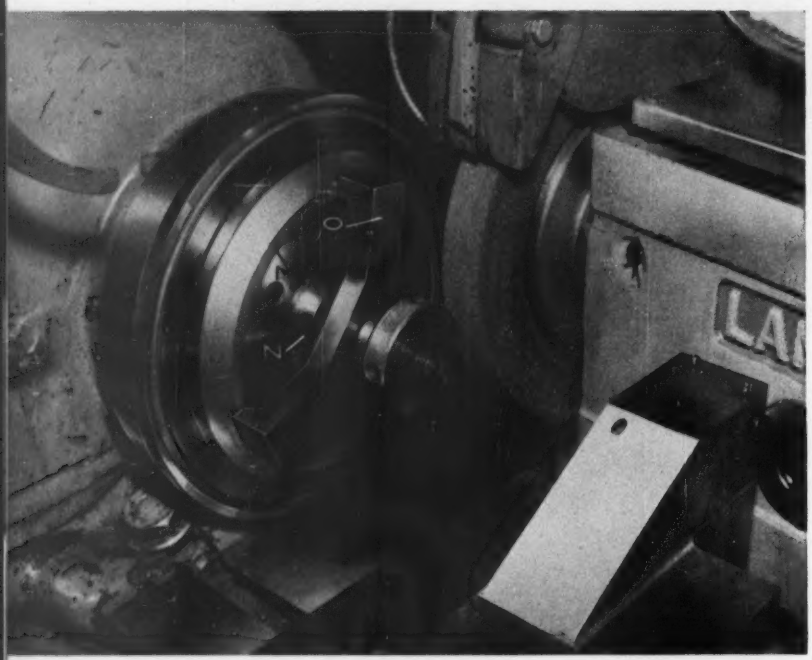


Fig. 4. Three pins within the step (M) expand radially to center the roller race for concentric grinding of outside diameter. Clamping pressure is exerted against the face of the work.

two edges of each plunger that are adjacent to the shoulder pads, and which taper inward from top to bottom, press the studs against the pads. Twenty-four studs are thus held and ground simultaneously. Back-stops *L* absorb the endwise thrust of the surface grinding operation.

After the first flat has been ground, the studs are revolved 180 degrees to bring this flat against the faceplate, and the second flat is then ground. Continuous production is provided by employing two faceplates, one being unloaded and reloaded while the other is on the machine. The fixture holds the studs effectively without marring the threads, with ample area for flatting provided above the plungers and pads.

Grinding the outside diameter of roller races to a high degree of concentricity with their inside diameter was facilitated by the fixture shown in Fig. 4. The work is accommodated over a step *M* made 0.010 inch less than the bore of the race. Centering is performed by three steel pins, located 120 degrees apart. These pins are of identical length and have a close fit in holes drilled radially through the outside diameter of the step.

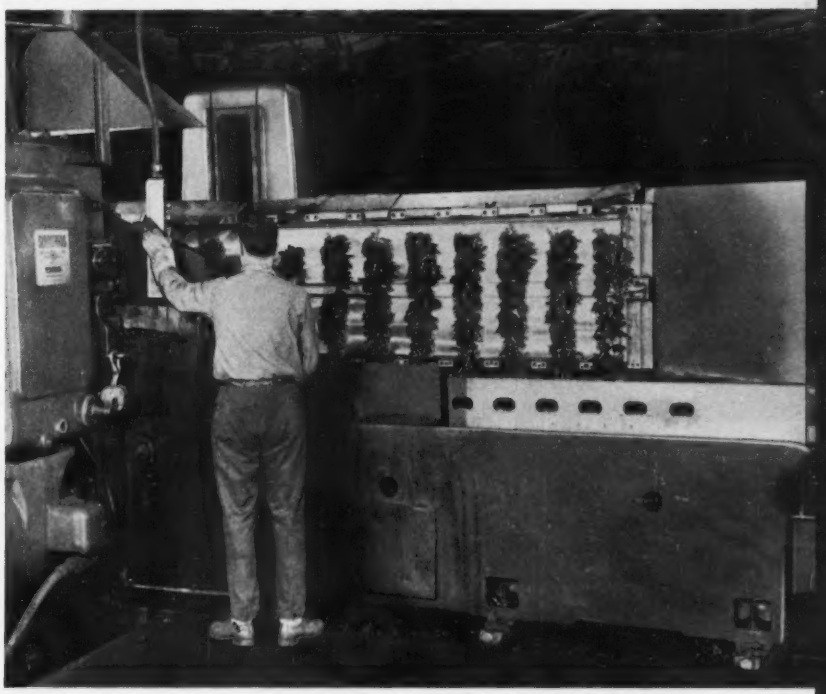
The inner ends of the pins bear around a tapered plug which runs through a boss *N* to the front of the fixture. A spring (not visible) next to the boss maintains a light pressure against the plug, and in this manner forces the three pins outward the same distance. The thrust of the pins is sufficient to center the race without distorting it. A triangular clamp *O* held by a knurled nut secures the work in the fixture.

U. S. Steel Pours One Billionth Ton of Steel

The United States Steel Co. recently poured its one billionth ton of steel. No other company in history and no other nation on earth has even equalled this production record. It took fifty-one years, seven months, and twenty-five days and the combined efforts and ingenuity of tens of thousands of men—and women, too—for the corporation's mills to become the first in the history of steel-making to reach a billion tons. If it were possible to maintain today's greatly accelerated pace, it would take only thirty years to produce the second billionth ton in the present mills of United States Steel, which represent only about one-third of the steel industry in this country.

A billion tons of steel represents 36 1/2 tons produced every minute since 1901—day and night. A billion tons of steel is enough to build a bridge with a 22-foot roadway around the earth seven and one-half times at the equator, or stretch a piano wire from the earth thirteen times up to Pluto and back, the most distant planet in the solar system (eighty-six billion miles away), or if rolled into standard 18 gage sheets 18 inches wide to reach the sun, ninety million miles away. Instead of an iron curtain—had we ever needed or wanted one—this billion tons of steel could have built a solid steel wall 10 feet high, 4 1/3 feet thick, and nearly 18,000 miles long around the entire perimeter of the United States.

Rigidmils Fashion Aircraft Propellers



THOSE "barnacles" in the picture above are chips clustered around the pole areas of a magnetic chuck upon completion of a milling operation, just before the chuck is de-energized. They form a dramatic part of a record rate of stock removal attained in milling blade plates for the hollow steel propellers of Convair B-36 Intercontinental bombers. The machine illustrated is one of six Sundstrand Rigidmils installed in the Propeller Division of the Curtiss-Wright Corporation, Caldwell, N. J.

Two plates are subsequently welded together and shaped into the camber and thrust surfaces of each blade, making thirty-six plates that are required for the six three-blade propellers of each bomber. The 19-foot diameter of the propellers, incidentally, makes them the largest currently in production. The plates are made of

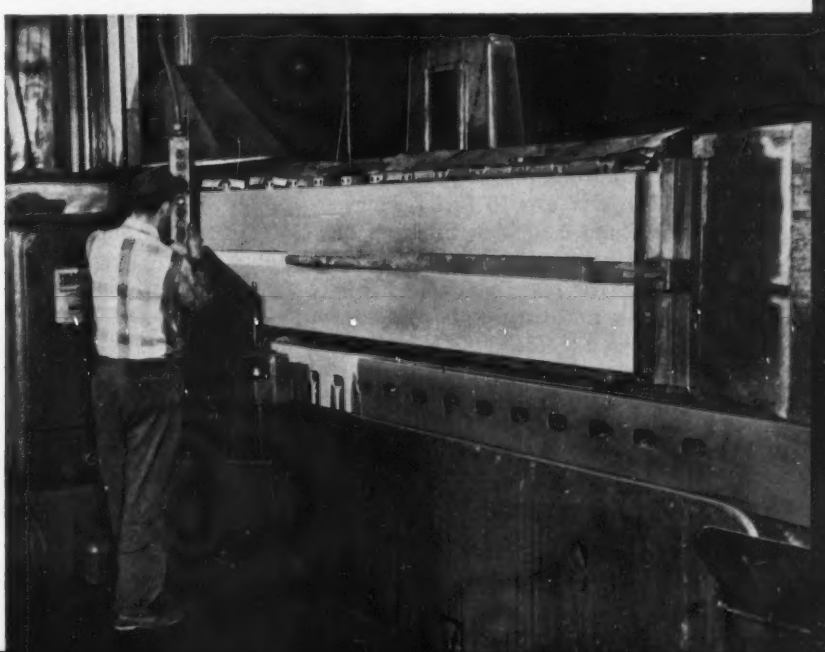


Fig. 1. A camber plate for a B-36 propeller blade in position for face-milling. Leading and trailing edges are milled successively on the forward and return strokes of the table. Locating holes in plate engage pins in chuck.

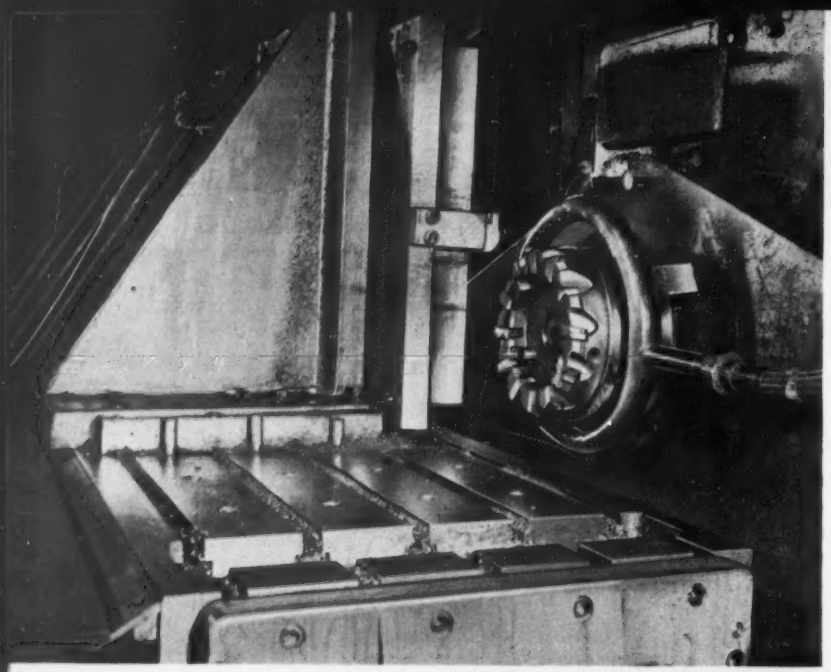


Fig. 2. Looking at the rough-milling operation from the rear of the machine. Right-angle type Sundstrand magnetic "Power-Grip" chuck is fastened to the table at the required degree of taper.

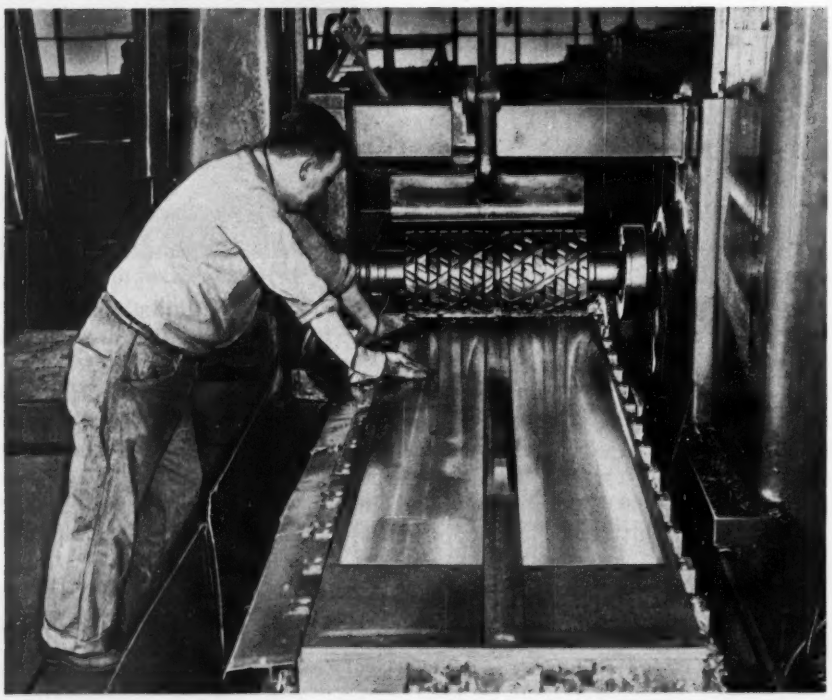


Fig. 3. View shows the alternate helixes of cutter teeth. This design affords the advantage of shearing action without the disadvantage of side thrust.

tough chromium-molybdenum-nickel steel (SAE 4320), and are 10 feet 5 inches long, 25 inches wide, and 0.80 inch thick on delivery.

A rib centrally located on the long axis of one side of the plate serves as a stiffener. When the camber and thrust plates are afterward atomic-hydrogen welded, the joint is made at the ribs. Prior to being brought to the Rigidmils, the plates are straightened on a Birdsboro press to a tolerance of 0.030 inch, then a fixture locating hole is drilled and reamed in the shank end, and another hole is pierced in the tip end.

The two Rigidmil operations performed consist first of rough-milling, and then of fillet milling on the rib side of the plates. Curtiss-Wright identifies these operations as "vertical roughing" and "oversizing," respectively. Specifications call for a tapered cut running 8 feet 11 inches, from zero depth at the shank to a depth of 0.39 inch at the tip.

For the rough-milling operation, the plate is positioned vertically against a powerful magnetic chuck, as in Fig. 1. On the forward stroke of the table of the planer type milling machine, the leading edge of the plate is cut. After this the head is automatically raised and the trailing

edge is cut on the return stroke. Despite the mammoth proportions of the machine, all movements of the table and spindle are conveniently controlled from a push-button station.

In Fig. 2 is a view from the rear of the machine, showing the milling cutter used for the operation. The 12-inch diameter cutter, made by the O. K. Tool Co., Inc., has twelve carbide insert type teeth, secured in slots in the body by interlocking wedge-shaped serrated surfaces. Instead of being radial, the slots are arranged to give the teeth a slight negative rake. Coolant is distributed to the cutting teeth through a perforated ring which encloses the cutter. A motor rating of 75 H. P. makes possible a spindle speed of 225 revolutions per minute and a table feed of 25 inches per minute. Floor-to-floor time of less than sixteen minutes for each blade contrasts strikingly with the two hours required by a previous machining method.

Further stock reduction—oversizing—is performed on a Rigidmil set up for a horizontal operation, Fig. 3. With the plate supported so that the rough-milled tapered surfaces are level, the table is fed at a rate of 8 1/4 inches per minute. A row of sixteen cutters is mounted on the spindle arbor, straddling the rib in the plate. The teeth are helical cut and staggered to produce a continuous surface. Balanced cutting action is obtained by the alternate hand of the helix of successive teeth, and by the flywheel incorporated in the spindle arbor. The massive outboard arbor support, the heavy rectangular over-arm, and the "fluid screw" design of the table feed all combine to permit a successful application of the climb-milling principle. One of the plates nearing completion of the cut is illustrated in Fig. 4.

* * *

Westinghouse Building "Skyscraper" Heat-Treating Furnace

An unusual furnace now being built for an aluminum plant by the Westinghouse Electric Corporation will stand as high as a thirteen-story office building. This vertical furnace will be used to heat-treat long extruded aluminum shapes required primarily by airframe builders. Aluminum pieces 110 feet long will be suspended in a heat-treating tower, which stands about 130 feet high. Following the heat bath, the suspended pieces will be dropped into a water-filled pit for quenching.

In these furnaces, temperature must be held within close limits—between 915 and 935 degrees F. Also, the temperature difference between the top and bottom of the tower must be slight. To accomplish this, a high rate of gas circulation is maintained. Combustion takes place in one tower, and the heated air is directed into the top of the heat-treating tower standing beside it. Furnaces of this type were built during World War II and improved models have been constructed in recent years. None, however, accommodates extrusions longer than 60 feet.

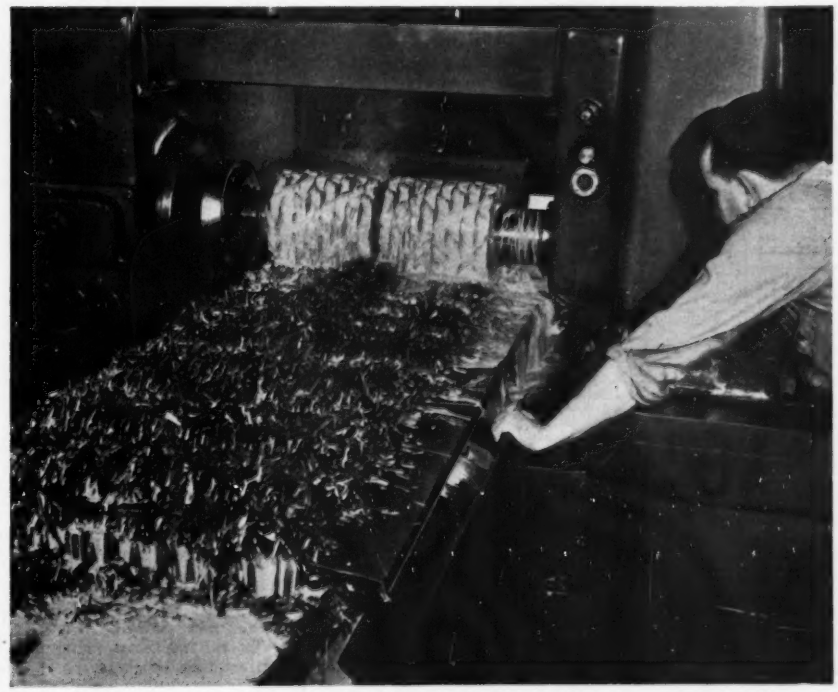


Fig. 4. The parallel mounds in which the chips are clustered are over the pole areas of the magnetic chuck.

Application of Lubricants to Anti-Friction Bearings

The Principles of Proper Anti-Friction Bearing Lubrication are Described in This Article, the Last of a Series.

By LEE BALLARD
Tide Water Associated Oil Co.
New York, N. Y.

OILS and greases for ball and roller bearings serve to reduce friction between the balls or rollers and their retainers or cages; to provide protection against corrosion for the highly finished surfaces of balls or rollers, races, and retainers; to assist in forming a seal for preventing the entrance of moisture, dirt, and abrasive material into the housings; and to aid in dissipating frictional heat.

Oil is more desirable than grease for high-speed ball or roller bearings, since it offers less resistance to motion. It is difficult, however, to keep housings absolutely oil-tight, and unless the housing and the method of application are specially designed for oil lubrication, it is generally necessary to use grease because of its greater ability to resist leakage. For rolling-mill roll neck and other bearings operating in the presence of water and abrasive materials, grease is more effective than oil in providing a seal to guard against the entrance of contaminants.

The viscosity of the oil used may have an important effect on frictional losses, because oils that are too high in viscosity will result in the generation of unnecessary frictional heat, as seen on the chart in Fig. 1. The selection of an oil of suitable viscosity is not difficult since the requirements for anti-friction bearings are similar to those for plain bearings, in that low-speed and heavy-duty bearings should use oils of higher viscosity than high-speed or lightly loaded bearings. Also, external temperature conditions must be considered as in the case of plain bearings.

Grease-lubricated anti-friction bearings present a more difficult problem. Grease is a mixture of oil and soap, and both ingredients influence the properties of the grease and its ability to provide efficient lubrication under specified conditions of speed, load, and operating temperature. If the grease is not of the correct consistency or type for the operating conditions, oil and soap may separate—with the result that the soap is deposited in the bearing where it interferes with proper operation.

With minor exceptions commercial greases for ball and roller bearings are made with calcium,

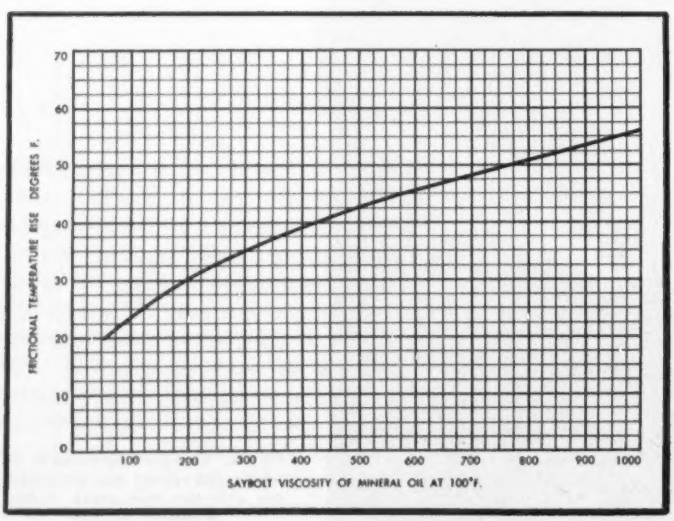
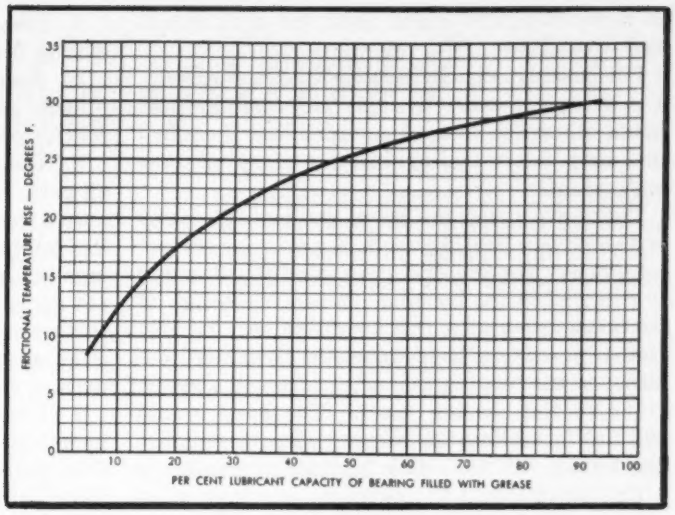


Fig. 1. Chart of a typical curve showing the effect of oil viscosity on the frictional temperature rise of anti-friction bearings

Fig. 2. A typical curve showing the effect of the quantity of grease used in lubricating anti-friction bearings on frictional temperature rise



sodium, barium, or lithium soaps, or combinations of two or more of these soaps. Greases for bearings subjected to extremely heavy pressures and shock loads may also contain extreme-pressure bases.

Calcium soap greases are suitable for anti-friction bearings operating at temperatures under 150 degrees F. (65 degrees C.), particularly when speeds are low or moderate. These greases are also preferable when bearings are exposed to streams of water, as they do not readily emulsify and are, therefore, not easily washed off. Sodium and lithium soap greases are suitable for bearings operating at high temperature and high speed.

Graphite greases are not generally desirable for anti-friction bearings. Greases containing natural, or flake, graphite should never be used. This type of graphite contains mineral constituents which may damage the highly polished surfaces. In heavy industries, electric furnace graphite, which is substantially ash-free, is sometimes desirable. A small percentage of this type of graphite in a grease is not harmful in large, low-speed bearings.

Bearing Difficulties Due to Improper Lubrication

Lubricants in anti-friction bearings are subjected to various deteriorating influences. These include the effects of temperature, load conditions, contaminants, and the churning action of the balls or rollers on the lubricant. The last-mentioned, in turn, is affected by the viscosity of the lubricant and the quantity present in the housing.

The major cause of anti-friction bearing failure is overlubrication. This is not so common on oil-lubricated bearings because such bearings are usually equipped with an overflow which controls the oil level. In other methods of application, the oil is supplied by wicks or in the form of a spray or mist which prevents overlubrication. The level of the lubricant in an oil-bath lubricated bearing should be such that approximately half of the ball or roller is submerged when in lowermost position. When the level is higher than necessary, the severe agitation of the excess oil results in unnecessary frictional heat. In addition to increasing power losses, high oil levels also tend to promote objectionable leakage.

When grease is applied by means of a hand-operated gun, it is sometimes the practice to force it into the housing until full. This is objectionable for high-speed bearings because the churning action of the balls or rollers creates excessively high temperatures, which promote leakage and impair the efficiency of the lubricant. In Fig. 2 is shown the effect of the quantity of grease on frictional temperature rise in anti-friction bearings.

Bearings with good seals do not usually require attention more often than once in three to six months, but individual bearing characteristics must determine the proper interval between applications. Housings of grease-lubricated medium- or high-speed bearings should be maintained not more than one-third full. An effective method of controlling the quantity of grease applied to anti-friction bearings is to remove the drain plug in the bottom of the housing and, while the bearing is running, apply grease with a gun until it starts to come out of the drain. Then allow the bearing to operate with the drain open so that excess grease will be forced out. When the grease ceases to flow from the drain, the plug should be replaced and

no more lubricant added until the next scheduled application.

For bearings exposed to moisture or abrasives, it is often necessary to apply more grease than would otherwise be used, in order that the lubricant may better seal against the entry of these contaminants.

There are occasions when, because of faulty or inadequate bearing seals, a grease of correct consistency for the operating conditions cannot be retained in the housing. When the design of the housing permits, this condition may be alleviated by using a hard grease in the cavity adjacent to the bearing seal or closure and a softer grade in the bearing itself. The hard grease will aid in sealing the bearing and prevent undue leakage of the softer lubricating grade.

Overloading and the entrance of abrasive or corrosive impurities also contribute to bearing failures. The first evidence of failure of bearings that are overloaded or subjected to excessive shock loads is the pitting of the balls or rollers and the races. The metal flaked off in this pitting action mixes with the lubricant, causing abrasion which hastens failure.

The rolling elements and races of anti-friction bearings deform somewhat in the pressure area. When the load is greater than that for which the bearing is designed, repeated deformation hastens fatigue of the metal. Small cracks appear, from which metal is eventually flaked off, leaving pits. Their growth is influenced by the hydraulic action of the bearing. Fatigue pitting has a characteristic shape which makes it easy to recognize. This is mentioned as fatigue pitting is often wrongly attributed to the lubricant.

Anti-friction bearing troubles traceable to faulty lubrication may be due to the disintegration of grease structures by severe agitation or heat. The result may be the separation of oil from soap. Another source of this trouble may be oxidation of the lubricant, resulting in gummy deposits which interfere with smooth bearing operation. Oxidation of grease generally starts with the oil in making the grease and not the soap, hence the desirability of using greases containing good quality oils.

Hints for Efficient Lubrication of Anti-Friction Bearings

1. Do not fill medium- or high-speed grease lubricated bearings more than one-third full of lubricant.

2. Do not put more oil in bath lubricated bearings than necessary to submerge half of the lowest balls or rollers.

3. Apply lubricant only when necessary, and in controlled quantities.

4. Use oils and greases of the correct type and quality for the operating conditions.

5. Keep seals and closures tight in order to prevent the entrance of any corrosive or abrasive impurities.

6. Dismantle bearings and thoroughly clean all parts at periodic intervals, preferably at least once a year. Bearings subjected to high operating temperatures require more frequent cleanings to assure freedom from deposits. This does not apply to prelubricated bearings sealed at the factory for life, as these bearings do not require cleaning or replenishment of lubricant under normal conditions.

7. Use magnetic drain plugs in housings of industrial machines, or assemblies such as reduction gears lubricated by splash or circulation methods, to attract, and retain, any free metal particles present as a result of wear or fatigue. This aids in preventing such metal particles from being carried with the oil and causing bearing damage.

* * *

Resistance Welder Manufacturers Association Announces Contest

Cash awards totaling $2250 await writers of winning papers in the 1953 contest of the Resistance Welder Manufacturers Association. Subject matter may concern redesign of a product to make possible or improve fabrication by resistance welding, resistance welding research, development of new procedures to broaden the field of application of resistance welding, etc. Three different classes of eligibility have been established: industry class, with first, second, and third prizes of $750, $500, and $250, respectively; university staff class, with a $300 first prize and a $200 second prize; and university undergraduate class, with a $250 prize. Complete details and rules of the contest can be obtained from the Resistance Welder Manufacturers Association, 1900 Arch St., Philadelphia 3, Pa.

* * *

Requirements for Steel Production

To produce 1951's record 105 million tons of ingots and steel for castings, America's steel factories needed 130 million tons of iron ore, 100 million tons of coal, 68 million tons of coke, 36 million tons of limestone, 58 million tons of scrap, 2500 million gallons of fuel oil, 284 million gallons of tar and pitch, 207,000 million cubic feet or natural gas, and 27,611 million K.W.H. of electric power.

INGENIOUS *Mechanisms*

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

"Jamproof" Feeding Mechanism

By HAIM MURRO

The two drawings shown present an interesting materials handling system for advancing small parts onto a feed track. The system possesses merit because of the manner in which the feed rate is controlled to prevent any parts from jamming on the track. In this instance, small round-head screw blanks are being fed into a threading machine.

A shallow pan *A*, Fig. 1, holds a batch of screws. This pan rotates at approximately 40 R.P.M., and the axis of rotation is inclined. As the pan rotates, the screws are directed onto a fork *B*, where some of the screws will align themselves and hang by their heads. At its other end, the fork is hinged to the feed track *C*, the surface of which forms a true continuation with that of the fork.

The fork is intermittently raised to the position shown by the broken lines, where the screws on the fork can slide onto the feed track. This movement of the fork originates from a cam (not shown) rotating on the bottom of a vertical stem *D* joined to the fork by a link *E*. As the cam slowly rotates, it intermittently raises the stem, then lets the stem fall down. In this manner, the fork is also intermittently raised or lowered.

When the pan is rather full, each time the fork is raised it may deliver more screws than can be accommodated on the feed track. Consequently, there may be a serious jam on the track, if it were not for a feeling finger *F* which is incorpor-

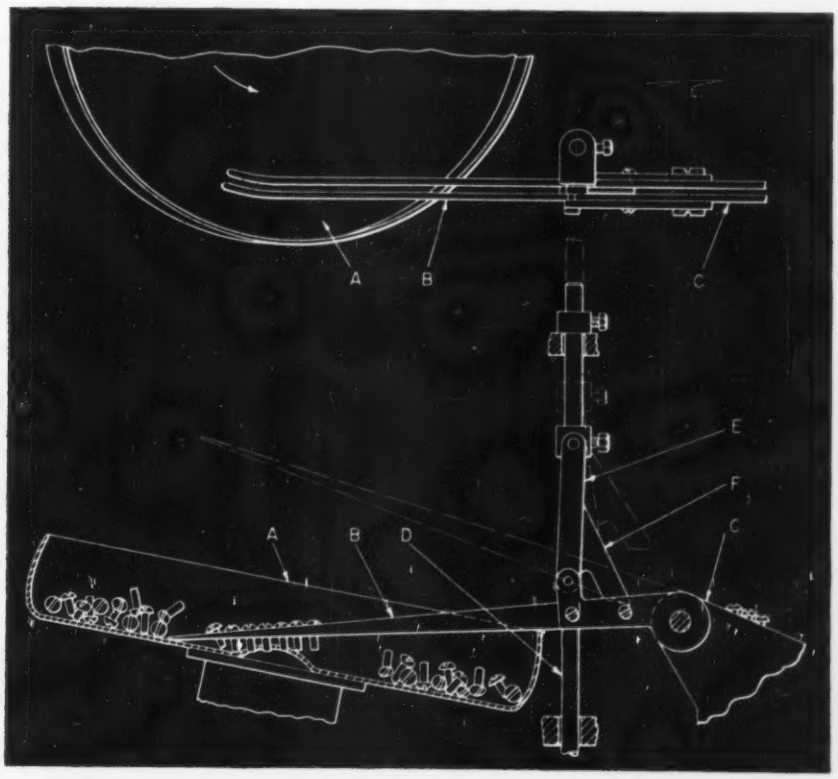


Fig. 1. When the track is not congested, the fork can drop into the pan to pick up screws.

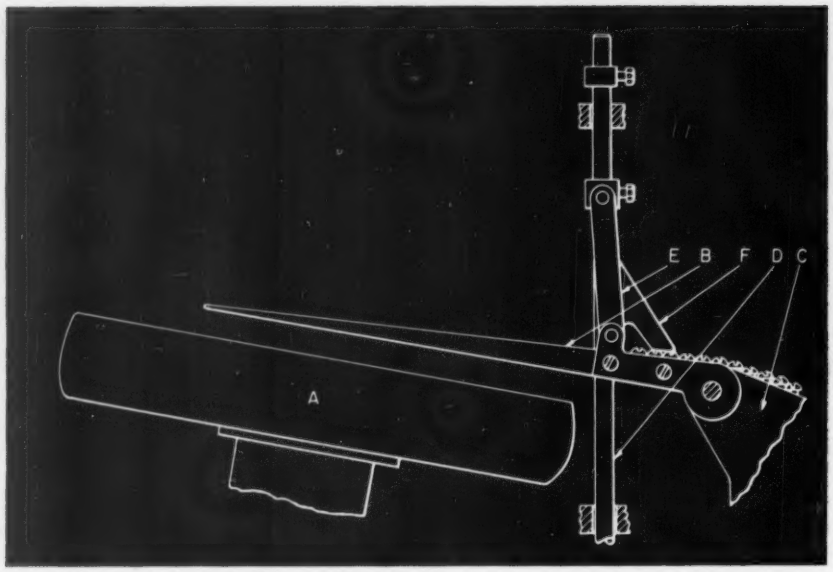


Fig. 2. When the track is congested, the feeling finger prevents the fork from dropping into the pan.

ated in the mechanism. This finger is fixed to the stem, and moves up and down with it.

If the line of screws in the track extends back onto the fork, as in Fig. 2, then the down stroke of the stem is arrested when the finger strikes the heads of the screws. Since the stem and fork are linked together, the fork does not swing completely down into the pan until the congestion on the track has ended. Then, as in Fig. 1, the finger can enter the track during the reciprocation of the stem, and the fork can drop into the pan in order to pick up more screws.

Constant Specific Pressures for Blank-Holders in Drawing Dies

By FEDERICO STRASSER

The use of blank-holders with drawing dies is ordinarily necessary; the blank-holder forms a pressure pad against the rim of the blank and thus keeps the shell being drawn free from wrinkles. Exactly how much pressure is required to prevent wrinkling is best determined by trial and error. In the main, pressure is dependent on the thickness of the blank and the reduction ratio of the blank diameter to the shell diameter. The thinner the blank or the greater the reduction ratio, the greater the pressure required of the blank-holder. Pressure may also depend on the nature of the work material.

For single-action presses, blank-holding devices designed with compression springs or rubber cushions are popular because of the ease with which they can be installed. One serious drawback to their use, however, is the fact that the pressure exerted by them is not fixed, but varies, increasing as the drawing proceeds. The ideal condition would be to have the pressure decrease as the drawing proceeds, inasmuch as the area of the blank that can be maintained firmly by the blank-holder constantly diminishes. As a consequence, these devices are not satisfactory in deeper drawing operations. For if the pressure is right for creating the proper resistance to the movement of the blank into the die at the beginning of the stroke, then toward the end of the stroke the built-up pressure is so great that the shell is ruptured. Conversely, if less pressure is used in order to prevent a rupture, then wrinkles undoubtedly develop in the shell at the beginning of the stroke.

Both air-operated blank-holding devices and double-action presses exert constant pressures. They are, therefore, superior to compression spring or rubber cushion devices for the deeper draws. Not all plants, however, have ample facilities for air-operated devices, nor may double-action presses be available. Then, too, air-operated devices and double-action presses do not provide the ideal condition. What is wanted is not a constant pressure (in the sense of a fixed tonnage), but a constant *specific* pressure—that is, a constant pressure per square inch of held-down blank surface. In other words, what is wanted is a pressure that will decrease proportionately with the diminution of the hold-down surface of the blank as the drawing operation proceeds.

A novel method of obtaining a decreasing pressure is offered by the press adaptation illustrated in Figs. 1 and 2. The set-up is that of a

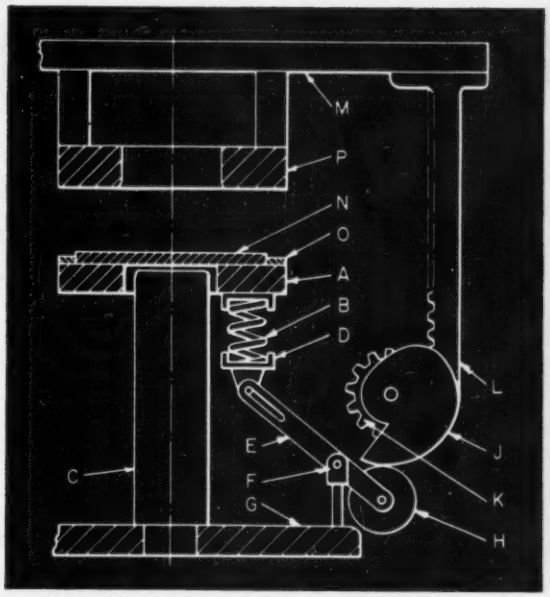


Fig. 1. At the start of the stroke, left end of lever is raised, and the blank-holder spring is fully compressed.

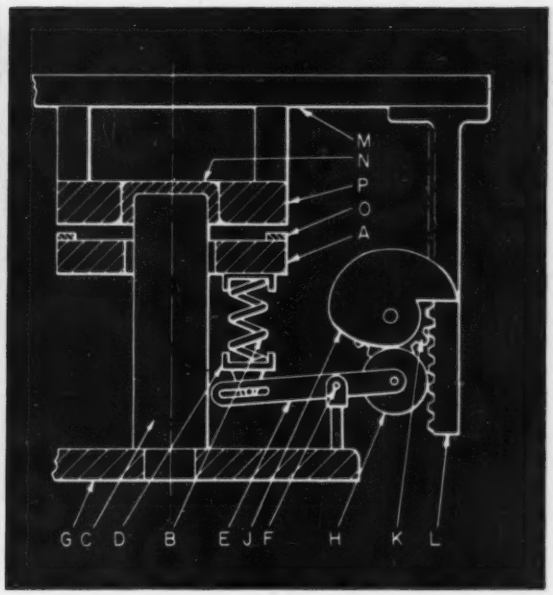
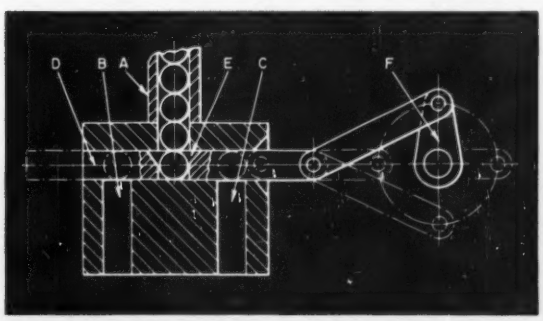


Fig. 2. At the completion of the stroke, left end of lever is lowered, and the spring has expanded.

typical inverted-die drawing operation in a conventional single-action press. Beneath the blank-holder *A* are several compression springs *B* (only one is shown) arranged around the punch *C*. The lower end of each spring is carried in a bracket *D*, pinned to a lever *E* which is able to fulcrum on a standard *F* attached to the lower member *G*. Pinned to the other end of the lever is a roller *H* in contact with a cam *J*. This cam is fastened to a pinion *K* which is fixed to the frame of the press, and which meshes with a vertical rack *L* supported from, and moving with, the upper member *M*.

At the start of the operation, as in Fig. 1, the blank *N* is placed in the nest *O* of the blank-holder and the press ram carrying the die *P* is made to descend. As the drawing proceeds, the downward movement of the rack, by rotating the cam, permits the spring to increase its length, and thereby decreases the pressure against the blank-holder. In Fig. 2 is shown the position of the components at the completion of the drawing.



Transfer of parts from one vertical plane to another is made possible by utilizing the principle of the crank.

Crank Principle Controls Shuttle Between Supply and Discharge Chutes

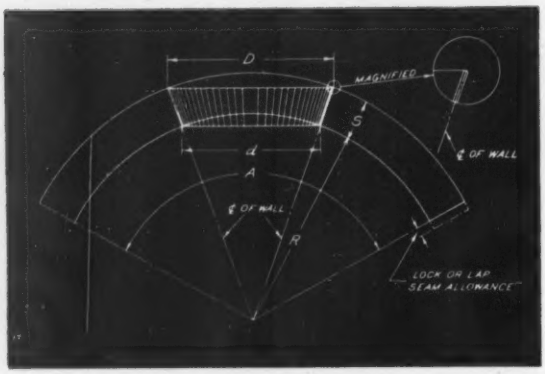
By ANDREW E. RYLANDER

The accompanying diagram represents a simple materials handling system for directing small objects—balls, screws, rivets, and the like—from a single supply chute *A* to two discharge chutes *B* and *C*. The transfer is made possible by the shuttle of a slide *D* in a channel. An opening *E* in the slide accommodates the parts, one by one. The right end of the slide is linked to a crank *F*.

When the crank is in a vertical position, either up or down, the slide opening is beneath the supply chute; when the crank is at "9 o'clock," the slide opening is over discharge chute *B*, and when at "3 o'clock," it is over discharge chute *C*. Thus, a part is delivered to each discharge chute for every complete revolution of the crank.

If a system is desired to shuttle objects to a single discharge chute, the motion of the crank is doubled. Thus, if all parts are to be transferred to discharge chute *B*, the opening would be beneath the supply chute when the crank is at "3 o'clock," and over the discharge chute when at "9 o'clock," one part being transferred for each complete revolution of the crank.

Ideas for Shop and Drafting-Room



In order to develop the frustum of a cone, (R) and (A) must first be found.

Method for Developing the Frustum of a Cone

By RONALD L. WAKELEE, Chicago, Ill.

Sheet-metal lay-out men are occasionally confronted with the problem of determining the development of the body of a thin-walled container which has the shape of a frustum of a cone, such as the shape represented by the shaded portion of the accompanying illustration. In the drawing, A is the center angle of the arc of the flat stock required to form the body, and D and d are diameters of the two bases of the frustum, measured at the center line of the wall.

To lay out the body, it is only necessary to find R and A from the following two equations:

$$R = \frac{Sd}{D - d} \qquad (1)$$

$$A = \frac{180\ (D - d)}{S} \qquad (2)$$

For example, if $D = 6$ inches, $d = 5$ inches, and $S = 1\ 1/2$ inches,

$$R = \frac{1\ 1/2 \times 5}{6 - 5} = 7.5 \text{ inches} \qquad (1)$$

$$A = \frac{180\ (6 - 5)}{1\ 1/2} = 120 \text{ degrees} \qquad (2)$$

For a lock or lap-seam joint, a small amount of stock must be added to one end of the lay-out, as shown in the drawing.

Handy Holder for Threading Die

By JOHN HOMEWOOD, Ontario, Calif.

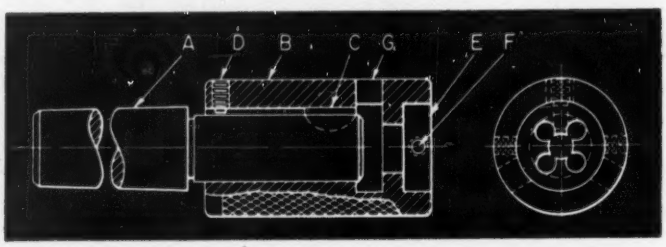
The tool shown in the illustration below is a most useful holder for small, fine-pitch threading dies. Shank A of the holder can be made tapered, as shown, or straight, depending upon the chuck to be used. The die-holder body B is a sliding fit on the reduced-diameter end of the shank, but is prevented from rotating on the shank by means of a Woodruff key C. A dog on the end of set-screw D projects into the keyway in the body to limit the distance that the body can slide and to retain it on the shank.

Threading die E is retained in body B by two set-screws F. Several radial holes G, entering a recess provided in the body directly behind the die opening, permit chips to escape from the body.

* * *

Reactor Holds Surface Speed Constant

A small reactor developed by Westinghouse for lathes having direct-current motors maintains constant surface speed during facing operations. This is done by automatically raising the spindle speed as the cutter feeds toward center. A cam is mounted in such a manner that a probe from the reactor can ride on it as the cut is taken. The slight vertical movement of the probe causes an armature to change the reluctance of the reactor magnetic circuit. An electronic exciter varies the motor field strength, changing the spindle speed to hold the surface speed constant.



Floating type threading die-holder especially suitable for cutting fine-pitch threads

TOOL ENGINEERING *Ideas*

Tools and Fixtures of Unusual Design and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Arbor Stabilizer for Horizontal Milling Machine

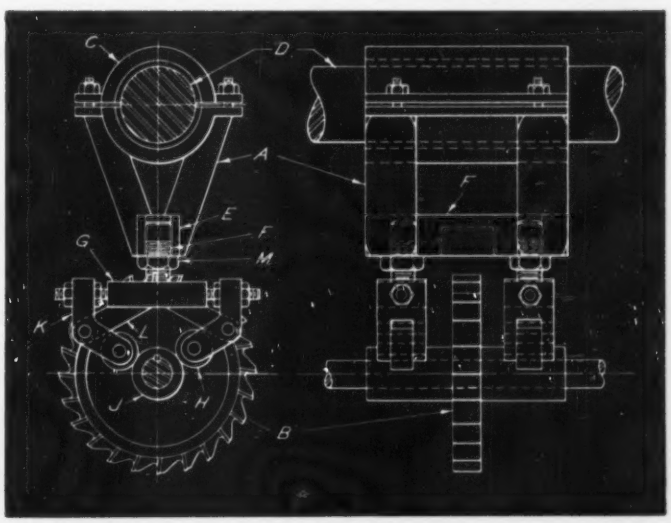
By C. H. WINTERBURN, Jackson, Mich.

A horizontal milling machine will sometimes set up a bad chatter when a peripheral cutter must be arranged near the midpoint of a long arbor. The consequence is a poor finish of the work-piece, most likely occurring on an old machine having pronounced wear in the spindle bearings—particularly where there is no regular intermediate arbor support on hand. The illustrated stabilizer, employing a roller pressure principle, is intended to correct this unfavorable condition.

Two V-shaped yokes *A*, one on either side of a cutter such as *B*, are welded to a split bushed liner *C* located on the over-arm *D* of the machine. The bottoms of the yokes have a milled channel *E* to receive the threaded studs *F* of cross-bars *G*. Hardened steel rollers *H* bear against the arbor spacing collars *J*, and are pinned to arms *K*. These arms are suspended at the ends of the cross-bars, and work around links *L* extending from the cross-bars. Necessary roller pressure is obtained by adjusting the position of a lock-nut *M* on the threaded stud *F*.

The position of the rollers enables them to absorb both lateral and vertical thrusts. Also, their position above the arbor center line leaves the cutter free to operate at the desired depth without obstruction. Cutters can be changed with a minor disassembly of the stabilizer, it being necessary only to loosen the lock-nut *M* on the front cross-bar stud, and to slide this unit out of the channel *E*.

For milling machines having double over-arms, or over-arms that are rectangular in cross-section, the yokes *A* and liners *C* will have to be designed accordingly.



The rollers (H) bear on the spacing collars of the arbor to eliminate chatter

Bore-Grinding Fixture for Bevel Gears

By F. WHITELEY

Grinding the bore and face of a bevel gear accurately concentric with the teeth, after heat-treatment, often presents difficulties when the only possible location is from the tooth surfaces. Various types of fixtures have been designed for this purpose. Many of them, while fairly satisfactory in operation, are expensive to produce, and easily lose their initial accuracy through wear of small parts, such as balls or pins, which are used to locate the work from the gear teeth. After some experience with the more complicated types of fixture, the design shown in Fig. 1 was developed, which not only proved quite successful, but also had the advantage of being comparatively inexpensive.

The gear to be ground, shown at *A*, is located in slots in the ring *B*, the number of slots cor-

responding to the number of teeth in the gear. The locating ring is fitted in the body C so that it is easily replaceable, and can also be reground on the front face while in position, should any wear or damage occur at the edges of the slots. Since the slots are parallel to the axis, grinding of the front face of the ring does not result in any change in their form.

The work is clamped by a ring nut D, the threads of which are made an easy or slack fit on the body. As an alternative to the ring nut, three clamps could be used, operated either independently or by a draw-bar with an equalizing device. The ring nut shown, however, is satisfactory, providing the threads are a slack fit, as stated, so that the back face of the gear controls the position of the nut.

Referring to Fig. 2 which shows the dimensions determining the shape and size of the work-locating slots:

ψ = pressure angle of gear on back face;
θ = angle of slot in locating ring;
ϕ = pitch cone angle of gear;
a = outside diameter of gear;
b = pitch circle diameter of gear;
c = addendum of gear tooth;
d = thickness of tip of basic rack on outside diameter a, and slot width on the line ZZ;
e = cone distance of gear;
f = distance from back face of gear to face XX of locating ring;
t = circular thickness of gear tooth on pitch circle diameter b;
t_x = width of slot on datum line YY;
h = distance from lines ZZ to YY;
YY = datum line through pitch cone line, and intersection of face of fixture XX;

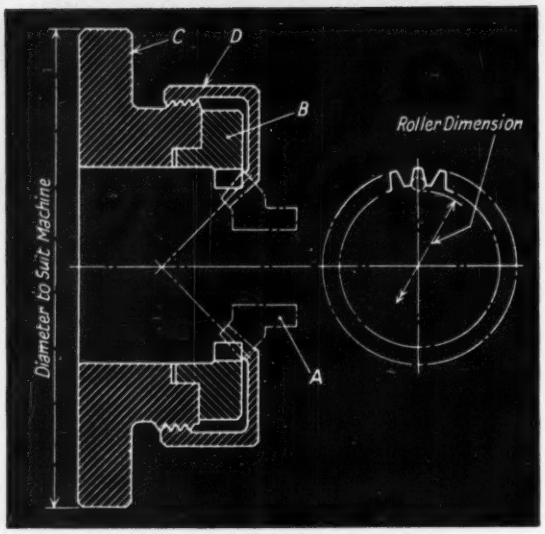


Fig. 1. Fixture for holding bevel gear to permit accurate grinding of bore concentric with pitch circle

ZZ = datum line at right angles to outside diameter a;
XX = front face of locating ring.

The values of d and the angle θ can be found either by making an enlarged lay-out as shown, or by calculation, using the following method:

Given the values t, c, and ψ from the gear drawing, then

$$d = t - 2\ (c \tan \psi)$$

The thickness of the tooth t_x on the line YY, and also the distance h, must next be determined in order to find the value of θ.

$$h = c \sec \phi \text{ and } f = c \cot \phi$$

then

$$t_x = \frac{e - f}{e}\, t$$

and

$$\tan \theta = \frac{(t_x - d)}{2h}$$

Having obtained the above values, it is a simple matter to calculate an inside roller dimension for use when making the locating ring. The slots are cut slightly deeper than the outside diameter of the gear to provide

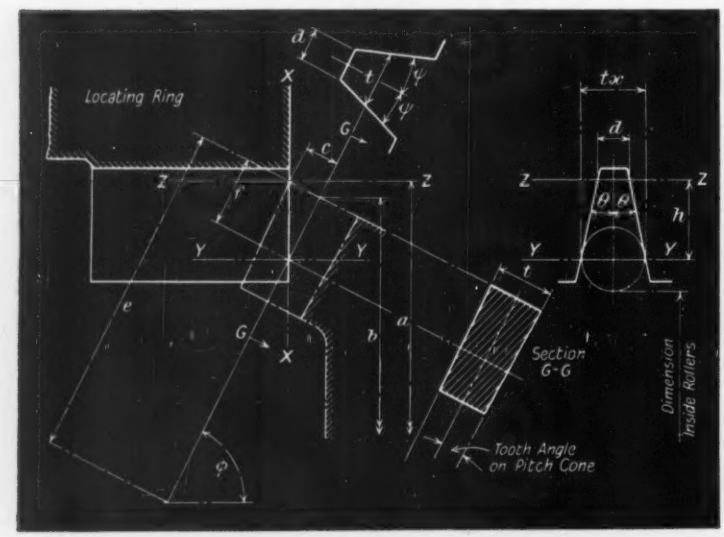


Fig. 2. Diagrams illustrating method of making enlarged scale lay-out drawings for determining shape and size of tooth-locating slots in fixture shown in Fig. 1

clearance, while the bore of the ring is such that it is well clear of the root line of the bevel gear teeth so that the gear can be held in place as shown in Fig. 1.

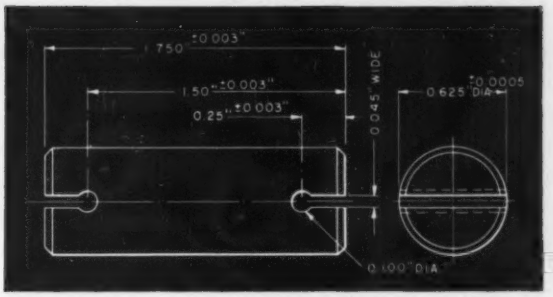


Fig. 1. Detail of fulcrum pin, or work-piece, both ends of which have been slot-milled in the fixture illustrated in Fig. 2.

Slot-Milling Fixture with a Sliding Locator

By W. M. HALLIDAY, Birkdale, Southport, England

Fulcrum pins of the design shown in Fig. 1 have slots milled across each end after the holes have been drilled, by employing a unique fixture. The fixture, designed as illustrated in Fig. 2, permits both slots to be milled simultaneously at a single setting by employing one locating pin. Body *A* of the fixture is mounted on base-plate *B*. A slot in the top surface of body *A* permits fastening support plate *D*. The left-hand end of this support plate has a 60-degree V-slot *F*, whose vertical axis is perpendicular to the base of the fixture.

Strap *G*, which clamps the fulcrum pin within the V-slot *F*, is anchored to twin tie-rods *H*, which in turn pass horizontally through support plate *D* and are attached to the steel link-plate *I*. Sufficient clearance exists between plate *I* and the right-hand end of plate *D* for loading and unloading the work-pieces. Clamping screw *J* is screwed through the center of the link-plate *I*, and bears against the end of plate *D*. This arrangement permits the work-piece to be clamped within V-slot *F*.

A cylindrical slide *K* is mounted in a hole extending through body *A* which is parallel to the machine table and whose axis bisects the angle of the V-slot *F*. A supporting pin *L*, held in place by locking screw *M*, is mounted vertically in a hole near the left-hand end of the cylindrical slide. Pin *L* supports and approximately positions the fulcrum pin at the correct height to facilitate entry of a locating pin *R* in the fulcrum pins when they are loaded in the fixture. A steel column *O* is fastened in recess *N* on the top center of the cylindrical slide and projects through elongated slots *Q* and *P* in body *A* and plate *D*, respectively. Locating pin *R* is affixed by means of screw *S* to the upper end of column *O* which projects over plate *D*. The front of pin *R* is rounded, and the contact portion of it is made long enough to enter slightly more than halfway into the hole in the work-piece.

Shoulder *T* of slide *K* at the right-hand end

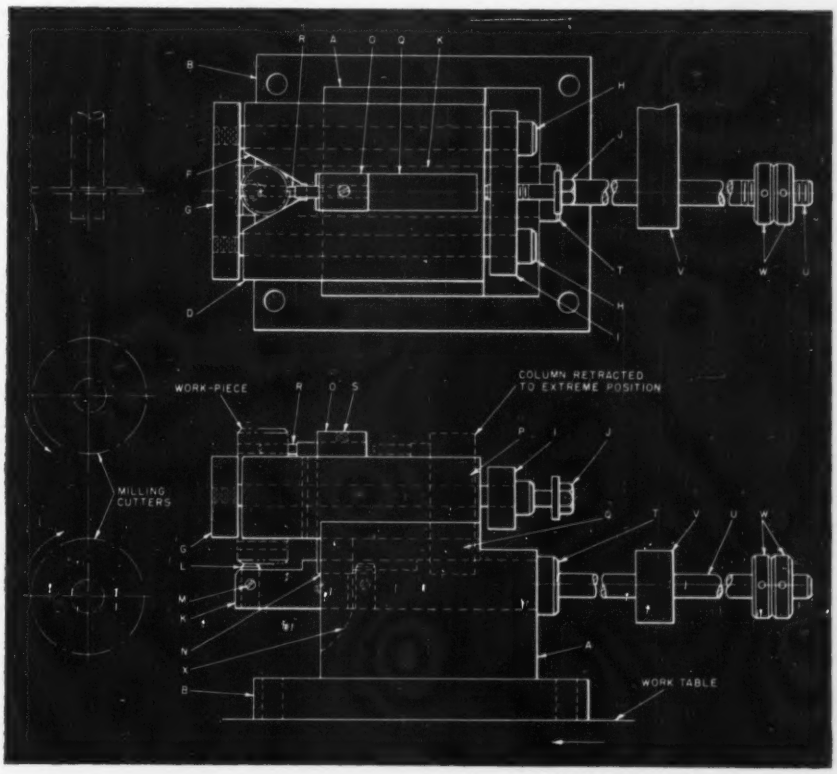
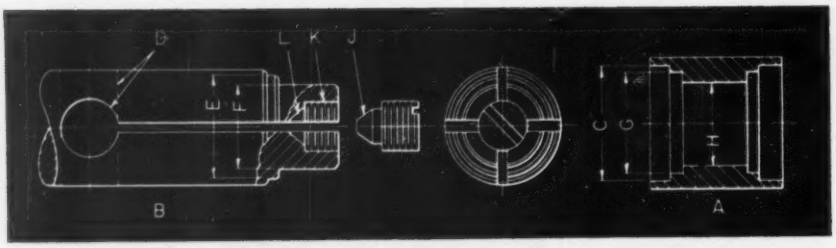


Fig. 2. This fixture employs the use of an automatically retractable sliding pin for the accurate and quick positioning of a fulcrum pin in a V-slot for slot-milling.



This simple expansion arbor assures the concentricity of the outside diameter with the bore of the bushing.

of body *A* acts as a positive stop to control the leftward movement of the slide. Beyond shoulder *T*, the cylindrical slide is extended for a considerable distance with a reduced diameter to form shank *U*. This shank portion passes through a hole in stationary stop-plate *V*, fastened to a machine column or knee bracket. The right-hand end portion of shank *U* is threaded for two collars *W* which may be locked together on the shank for the proper setting. There is a clearance slot *X* at the left-hand end of body *A* which provides proper clearance for the lower milling cutter.

In loading the fixture, strap *G* is released by means of screw *J*. Cylindrical slide *K* is retracted to bring pin *R* well away from the V-slot, if it is not already in the retracted position, by drawing on shank *U* or the upper projecting portion of column *O*. The fulcrum pin is then loosely placed in the V-slot, to rest on top of the supporting pin *L*. Cylindrical slide *K* is next slowly moved to the left until pin *R* engages the hole in the work-piece. When pin *R* is fully engaged, clamping screw *J* is tightened to draw strap *G* to the right and grip the work-piece in the V-slot.

As the fixture is moved toward the cutters in the milling operation, cylindrical slide *K*, locating pin *R*, and supporting pin *L* as a unit will be moved to the right by the action of collars *W* against the stationary plate *V*. This action, in effect, always provides a clearance between the advancing milling cutters and the retracting pins and slide.

Expansion Arbor for Secondary Lathe Operations

By MIRZA USMAN BEG, Karachi, Pakistan

A simple expansion arbor is a popular means of supporting a bushing when it is necessary to finish-turn an outside diameter to a high degree of concentricity with a previously completed bore. In the accompanying illustration are shown a typical bushing *A* and the arbor *B* which was used for the secondary operation. A short length of steel bar having a diameter somewhat less than that of the counterbore *C* is used for the arbor.

After two holes *D* are cross-drilled through the bar at right angles to each other, the two diameters *E* and *F* are turned. Diameter *E* is made somewhat less than counterbore *G*, and diameter *F* is roughed out to about 1/64 inch more than the diameter of the bore *H*.

A standard set-screw having a dog point is beveled as at *J*, and can be received in the tapped hole *K* in the end of the arbor. (In preparing the hole for the tap, the included angle of the tap drill should correspond to that of the bevel on the dog point.) As a next step, the body of the arbor is slotted lengthwise into four sectors, from the end to the two holes *D*. The slots are cut with a hacksaw at points on the diameter where they will intersect the holes.

It is now necessary to grip the arbor firmly in a collet chuck on the lathe in which the secondary operation is to be performed. The arbor should be extended so that the holes *D* are not within the collet; otherwise, the purpose in slotting the arbor to obtain a spring action will be defeated. With the set-screw hand-tight in the end of the arbor, diameter *F* is turned to a sliding fit with bore *H*. As a final step, the diameters of the arbor should be chamfered.

In operation, the bushings are slid on the arbor, after which the set-screw is tightened with a screwdriver or Allen wrench, as the case may be. The thrust of the bevel of the dog point against the conical surface *L* left by the tap drill expands the diameter *F* sufficiently to hold the bushing securely. After the outside diameter of the bushing has been turned, the set-screw is loosened. The arbor springs back to its normal diameter, and the bushing can then be removed.

* * *

Shipments of gear-cutting and gear-finishing machines in 1951 were valued at $38,300,000, 93 per cent over the previous year. Gear shapers, cutters, generators, and gear-finishing machines represented 72 per cent of the total value of shipments during 1951.

Progress of Air Force Heavy Press Program

DEMAND for large, light-alloy aircraft forgings will be met in 1954 when the United States Air Force Heavy Press Program is scheduled for completion. The first phase of this program will be completed either in late 1953 or early 1954 when a 35,000-ton and a 50,000-ton Loewy-Hydropress forging press will be installed in the Wyman-Gordon Co. plant at North Grafton, Mass. Other presses being built are another 50,000-ton, three 35,000-ton, and two 25,000-ton forging presses; and nine extrusion presses varying from 8000 to 20,000 tons capacity.

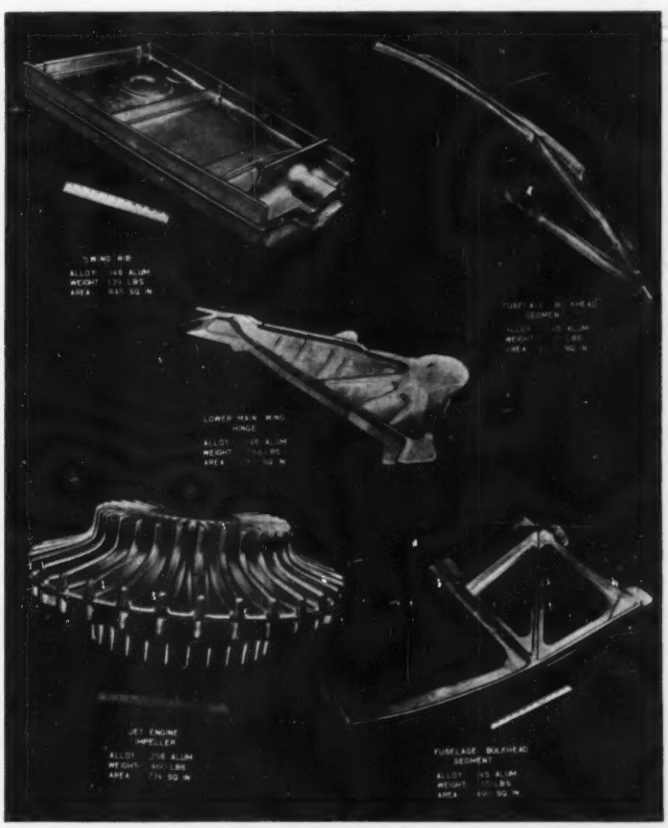
The Heavy Press Program was conceived as the result of successful operation of an 18,000-ton closed-die forging press in the North Grafton plant. Large forgings produced on this press have improved structural strength and weigh less than bolted, riveted, or welded assemblies.

Shown in the accompanying illustration are several of the many large forgings that have been produced on the 18,000-ton press. (Production of the jet-engine impeller and other parts was described in the article "Forging Aluminum and Magnesium on a Giant Hydraulic Press," published in October, 1947, MACHINERY.) On completion of the Heavy Press Program, much larger forgings will be possible. For example, the wing rib illustrated is made in right- and left-hand parts, the two parts being bolted together at assembly. With the larger presses now being manufactured, it will be possible to produce both parts as one forging.

The basis for the size and number of presses being procured under the Heavy Press Program was a comprehensive survey made by the Aircraft Industries Association of aircraft, press, and forging manufacturers. In the survey, more than 400 drawings of present and proposed forgings and anticipated production requirements were carefully analyzed. Estimated total cost of the Program—including design and building of the presses, and facilities—is $389,000,000.

Numerous problems have been encountered in building the huge presses. For example, about 100,000 tons of steel will be required from an already heavily loaded steel industry. Also, the existing capacity in this country did not permit the production of certain heavy castings—some weighing as much as 250 tons—and they had to be purchased in England, Japan, and other foreign countries. Facilities of our largest industrial plants and those of the United States Navy Shipyards have to be utilized to meet the tremendous machining problems encountered, and special railroad flat cars are necessary.

The 50,000-ton forging press will be equipped with nine main hydraulic cylinders, six pull-back and balancing cylinders, six eccentric load compensating cylinders, six press columns of rectangular laminated cross-section, and a pressure intensifier having a 3 to 2 ratio. Area of the die-bed will be 12 by 32 1/2 feet. The press will have a stroke of 6 feet with a speed of 480 inches per minute, and a daylight opening from 7 feet 9 inches to 13 feet 9 inches. A sliding table, consisting of the entire die-bed area and having a stroke of 32 1/2 feet, is provided. The press will have a height of 48 feet above the floor and will extend 66 feet below.



Typical large, light-alloy aircraft forgings produced on an 18,000-ton press at the North Grafton, Mass., plant of Wyman-Gordon Co.

Unusual Die Produces Metal-and-Felt Washers

A GOOD example of the type of operation economy that can be effected by the adoption of multiple-station press tools is afforded by equipment that has recently been designed and constructed by Black & Decker, Ltd., Harmondsworth, England. The part to be produced is an oil-retaining washer of the form shown at left center in the accompanying illustration. Each washer consists of a brass cup, produced from 0.018-inch thick material, pierced and dimpled in the center, and with the outer edge clinched to retain a disc of felt 1/16 inch thick. This washer is formed, punched, and assembled complete, from brass and felt strip, in six steps by means of the die shown.

At the first station, a relief hole is cut in the brass strip by the punch *A*, on either side of the disc which later becomes the cupped washer. Spring-loaded locating pins *B* enter this hole and insure correct positioning for the second station, at which the cup is formed by the punch *C*. A spring-loaded plunger *D* ejects the formed cup from the bushing *E* to enable the strip to be fed on to the third station. Here the central hole in the cup is pierced by the punch *F*.

At the fourth station, the central hole is dimpled by the coned die insert *G*, onto which the work is pressed by the form punch *H*. Felt strip is fed into the die at right angles to the brass strip by a grip-feeding mechanism *J* (section a–a), which is operated by cam-plates *K*, attached to the top plate of the punch assembly. This mechanism introduces the felt, at the fifth station, beneath a hollow-ended conical punch *L*, and a disc of felt is sheared from the strip against the top of bushing *M*. Continued descent of the punch *L* carries the disc downward until it rests in the cup, which is located in a lower bushing M_2. After the felt strip has been punched, it is fed beneath a scrap cutter blade *N*. Then the scrap pieces, guided by a sheet-metal guard *P*, fall through an opening in the bottom die-plate.

At the sixth station, the two remaining operations are completed—namely, punching the cup out of the strip and clinching it to retain the felt disc. The strip is first sheared by a hollow-ended conical punch *Q* against a die-plate *R*. During punching, the strip is held firmly in contact with the die-plate by a spring-loaded stripper *S*, after which the descending punch pushes the sheared cup downward onto the stop *T*. As the punch continues to move downward, it clinches the edge of the cup over that of the felt disc.

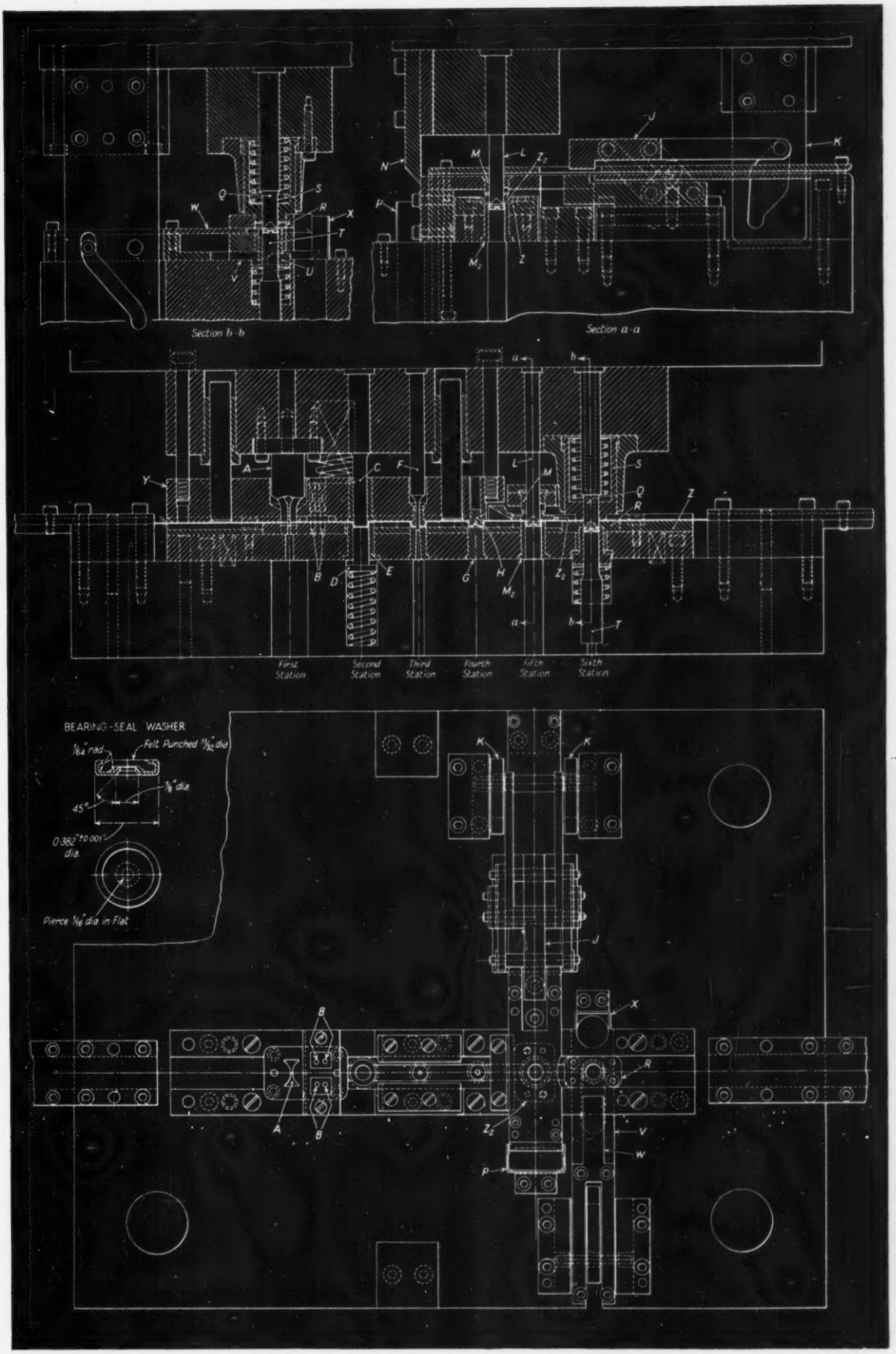
During clinching, the cup is located in the end of a bushing *U*, section b–b, which is spring-loaded in an upward direction. On the up stroke of the punch, this bushing is depressed by a wedge-plate *V*, which is operated simultaneously with an ejector blade *W* by a cam mechanism similar to that of the grip feed for the felt strip. Thus, when the bushing *U* is depressed, the work is left lying on the end of the stop *T*, and the ejector blade *W* pushes it from beneath the die-plate *R* into the tunnel formed by a guard-plate *X*, from which it finally falls through a hole in the bottom die-plate.

All the punches, with the exception of the one at the fourth station, are mounted in an upper punch-plate. A stripper plate *Y* surrounds the lower ends of the punches and is spring-loaded downward in the customary manner. At the fourth station, the form punch *H* is mounted in the stripper plate *Y* so that forming takes place against the spring pressure of the stripper plate. There is, in addition, a lower stripper plate *Z* which, spring-loaded in an upward direction, serves also as a guide for the brass strip. For this reason, the lower stripper plate is of a channel section, so that it guides the strip by the edges.

Accordingly when the punch assembly of the die is raised, the lower stripper plate rises also, lifting the cup projections clear of the bushings *E* and M_2, in order to permit feeding to the next station. Similarly, when the lower stripper plate reaches its upward limit of travel, the punch assembly continues to ascend, and the upper stripper plate comes into action to disengage the work from the punches. Meanwhile, the spring-loaded stripper *S* disengages the work strip from the last punch *Q*, thereby leaving the strip completely free for feeding to the next station.

It may be noted that the die-plate *R* is mounted directly on the bottom plate of the die assembly, and the action of the lower stripper plate *Z*,

(Opposite page) Plan and sectional views of the six-station die employed for producing the brass and felt bearing-seal washer shown at the left center. Felt strip is fed into the die at right angles to the brass strip by means of a grip-feeding mechanism seen in section a–a.


Section b-b
Section a-a
First Station
Second Station
Third Station
Fourth Station
Fifth Station
Sixth Station
BEARING-SEAL WASHER
Felt Punched 1/32" dia
1/64" rad.
1/8" dia.
45°
0.382" ±0.001" dia.
Pierce 1/16" dia. in Flat

after it has disengaged a cup from the preceding bushing M_2, is to raise the work strip so that the cup can slide over the surface of this die-plate R. When the punch descends, the stripper S seats the cup firmly in the die-plate opening, in readiness for the operation of the punch Q. At the preceding station, a stripper plate Z_2 bridges the guide channel Z, and must, therefore, move in relation to the fixed bushing M.

Nevertheless it is necessary to provide guidance for the felt disc throughout its downward travel into the cup located in the bushing M_2 and, for this reason, the plate Z_2 has a set of projections on its upper face, which engage corresponding recesses on the lower end of the bushing M. The length of the projections is such that they do not completely disengage, even when the lower stripper plate Z is fully depressed, and thus present, in effect, a continuous surface to the felt disc.

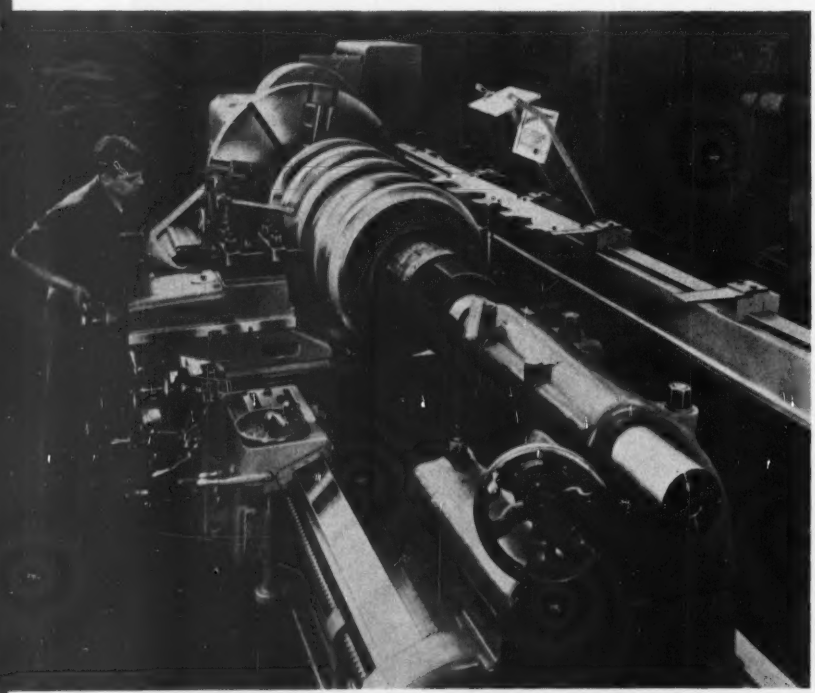
The tool is completely automatic in action, and all the operator does is to maintain the supply of strip brass and felt stock. Finished parts are produced without the additional work of using separate tools for cupping and assembly. Setting-up and maintenance are facilitated because the form punch H for the dimpling operation is mounted in the upper stripper plate, so that forming takes place against spring pressure. Consequently, the only critical depth control that is required is at the second and sixth stations. Depth is controlled at these stations by adjusting the stroke of the press.

New LeBlond 40-Inch Roll-Contouring Lathe

Two-directional hydraulic tracing makes possible the automatic turning of steep-angle contours on huge rolls used in steel mills. The new lathe will be demonstrated in the plant of the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, during the week of January 26 to 30. A tracing stylus following the contour of a flat template mounted at the back of the lathe actuates a valve which directs the movements of two hydraulic motors. One motor is mounted at the back of the carriage and drives the cross-feed screw; the other is in the conventional back-box position and powers the feed to the carriage.

Mechanical power rapid traverse to the carriage and cross-slide in both directions is built into the apron. Also, the hydraulic rapid traverse can be used to retract the cross-slide when under tracer control. The controls for the hydraulic system, as well as those for mechanical power rapid traverse, speed rate, feed rate, and spindle, are all located on the apron. The cross-feed can be by-passed and the carriage feed used separately. This feature is useful in roughing, enabling the operator to employ a manual cross-feed and use the template as a length stop.

The lathe is driven by a 40-H.P. direct-current motor, which provides for a variable speed range of from 1 to 165 R.P.M. The swing over the cross-slide is 28 inches.



Contouring on this 40-inch roll lathe is performed by the automatic coordination of hydraulic motors for the cross-slide and the carriage

THE SALES ENGINEER AND HIS PROBLEMS

By BERNARD LESTER
Lester and Silver
Sales Management Engineers
New York and Philadelphia

The Sales Engineer's Fiscal Year

THE fiscal year selected by a corporation may start any month. The close of the yearly period marks completion of a financial appraisal showing assets and liabilities, and the year's operating performance. New budgets and bogies are also adopted for the ensuing year. But for sales engineers the beginning of January is the best time to take an inventory, check gains and losses, and plan for the new year.

Like the corporation executive, most of us concentrate on conditions and figures, reviewing last year's sales and sizing up probable business conditions for the new year. Such thinking and action are distinctly objective.

But the most critical determining factors are not objective—they are subjective. In selling, the greatest influences on future performance are not statistical. They don't necessarily relate to how business looks. They relate to "me," and depend on the answers to those burning questions, What can I be and what can I do?

On life's stage we must turn from text and script to skill in acting. We must turn from marks put down on the page to personal attributes—to faith, sincerity, diplomacy, friendship, perseverance, and technical skill—and to traits that make men accomplish entirely different results under exactly the same conditions.

Check lists have become popular. The trouble is that we glance down the page from one item to another saying, "That's a good one to remember." Then we go ahead as we always have.

Here is a check list for us as salesmen, paralleling that of a corporation—of help only if we study ourselves, admitting we can improve.

Assets and Liabilities

Am I lax in matters of outward personal appearance or annoying mannerisms?

Am I buoyant, frank, and sincere, without spilling over too much with chatter?

Do I brag and make rash statements, or again, am I self-conscious and diffident?

Am I lopsided, fixing my faith too much in knowing people or, on the other hand, in knowing machines, materials, or processes?

Operating Statement

I'm busy, sure. I work hard and long, but are my visits and office work marked with efficiency?

Am I a source of information for my prospects on new and better ways to do a job—or am I just on the receiving end for the prospect's ideas? Unless I read trade and technical articles and advertisements, I can't keep a step ahead of my competitors.

Am I multiplying my selling reasons—focussing them factually in terms of customer benefits—or merely repeating the same old selling arguments?

Do I keep my friends and steadily add more?

Am I a "pain in the neck" to my headquarters because I constantly complain rather than give some constructive suggestions which have been well thought out?

Do I follow through, finishing jobs that I start?

Am I a good loser, but not an easy one?

Budget for 1953

Have I made a fair appraisal of my assets, liabilities, and past performance, and from these determined where I can improve?

Have I decided on the best methods of analyzing my progress?

Have I a plan for building a better reputation with customers and the home office?

As we review the last year, let's see what our balance sheet shows in the development of ability as a sales engineer. Let's make up a budget of improvements and, above all, determine to realize our projected plan.

LATEST DEVELOPMENTS IN *Shop*

Gardner Double-Spindle Machines Equipped for Grinding Turbine Blades and Axle Housings

Two double-spindle grinding machines equipped for specific production jobs have just been built by the Gardner Machine Co., 414 Gardner St., Beloit, Wis. The machine shown in Fig. 1 is designed to rough-grind the parallel ends of turbine blades like the one seen in Fig. 2. The ends of these blades are thus smoothed up preparatory to a hardness test that is made on the ground surfaces. The machine has a heavy cast-iron base which supports two grinding heads upon dovetailed slides that operate on ball-bearing ways. Centralized lubrication is provided for these ways.

The rotary attachment used on this machine has a work-carrier which is provided with twenty-six slots into which the turbine blades are manually loaded. A chain type hold-down arrangement can be seen in the close-up view, Fig. 3, which is designed to hold the work-pieces in the carrier during the grinding operation. The carriers are unloaded automatically after being released by the hold-down chain.

The power drive to the rotary attachment permits varying the speed of the work-carrier within

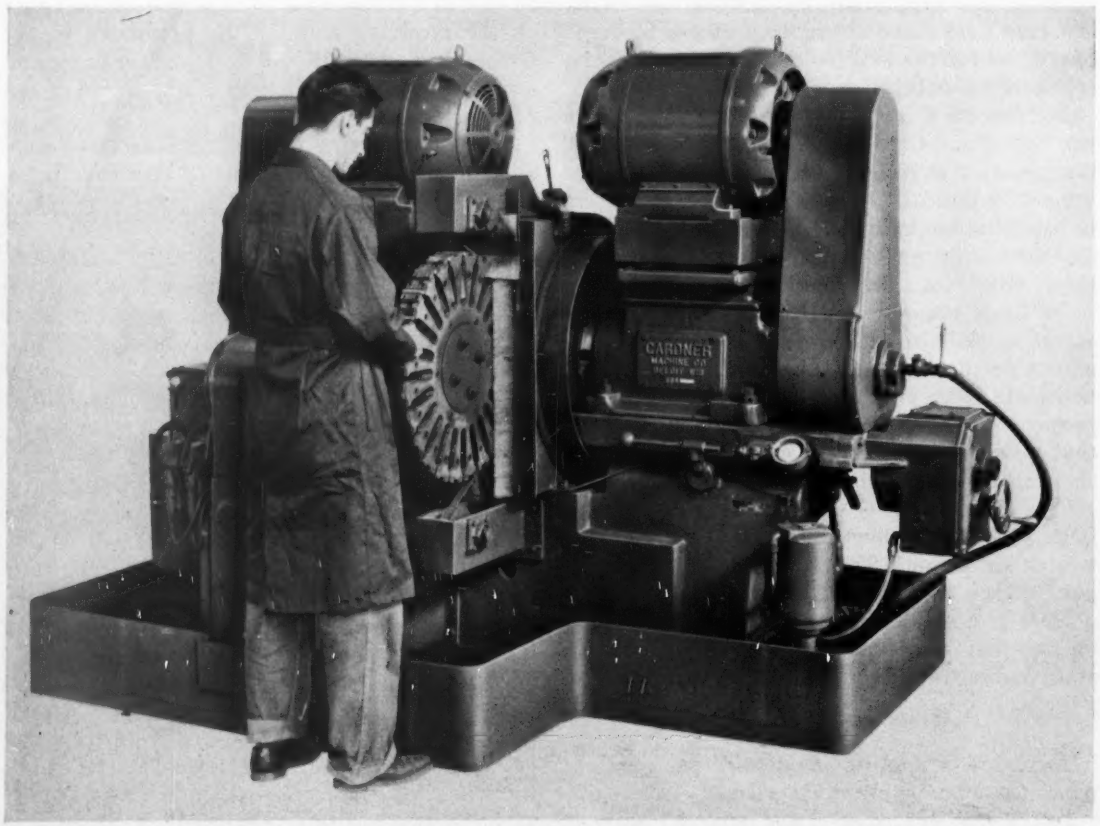


Fig. 1. Double-spindle turbine blade grinder with rotary work-carrier built by the Gardner Machine Co.

Equipment

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on Market

Edited by FREEMAN C. DUSTON

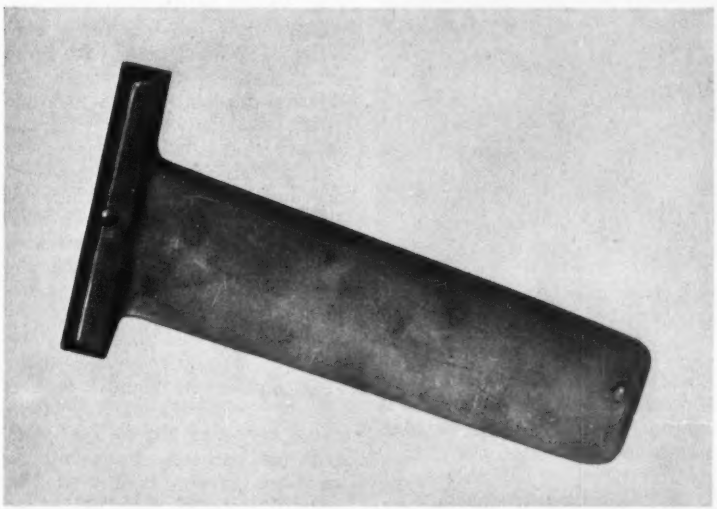


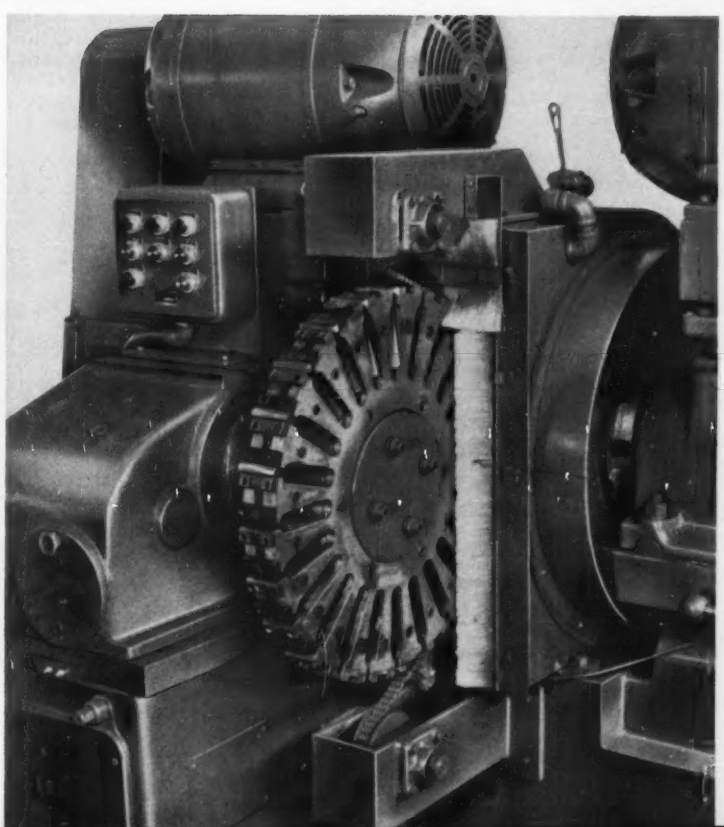
Fig. 2. (Left) Design of turbine blade loaded in the work-carrier illustrated in Fig. 3 for grinding the parallel ends of the base

Fig. 3. (Below) Close-up view of the rotary work-carrier employed on the Gardner double-spindle machine shown in Fig. 1 equipped for grinding turbine blades

a 3 to 1 ratio. Production is at the rate of twenty to twenty-five pieces per minute. Material to a maximum depth of about 1/16 inch is removed from each end of the turbine-blade base.

The double-spindle grinding machine shown in Fig. 4 has also been completed by the Gardner Machine Co. This machine is especially equipped for grinding the parallel faces of rear axle housings of trucks. It consists of a heavy cast-iron base supporting two opposed grinding heads upon slides having ball-bearings ways. Centralized lubrication is provided for the ways. The grinding heads operate hydraulically in taking the heavy facing cuts.

Upon the front of the base is mounted a special knee provided with dovetailed ways, on which a hydraulically operated sliding work-table is carried. A special fixture supports the rear axle housing during the grinding operation, locating the work-piece by means of plugs that make contact



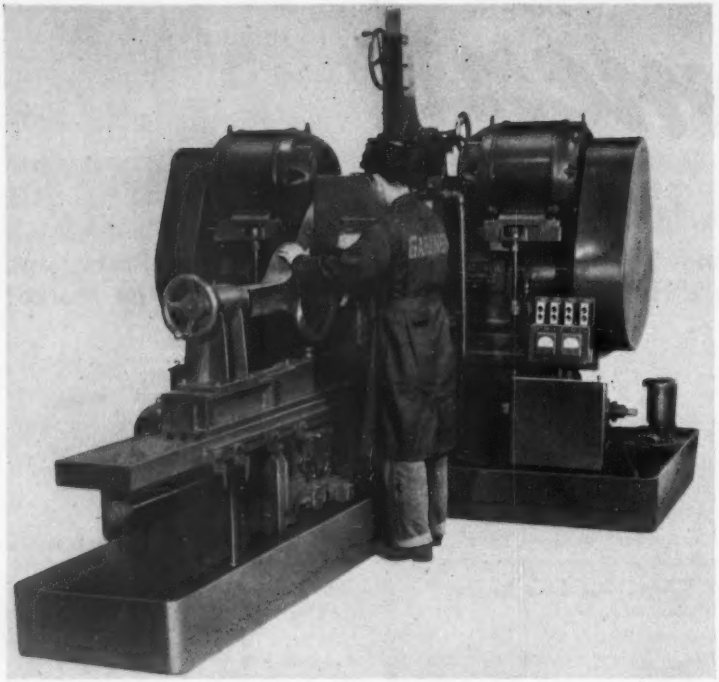


Fig. 4. Double-spindle grinder produced by Gardner Machine Co. for grinding parallel faces of rear axle housings

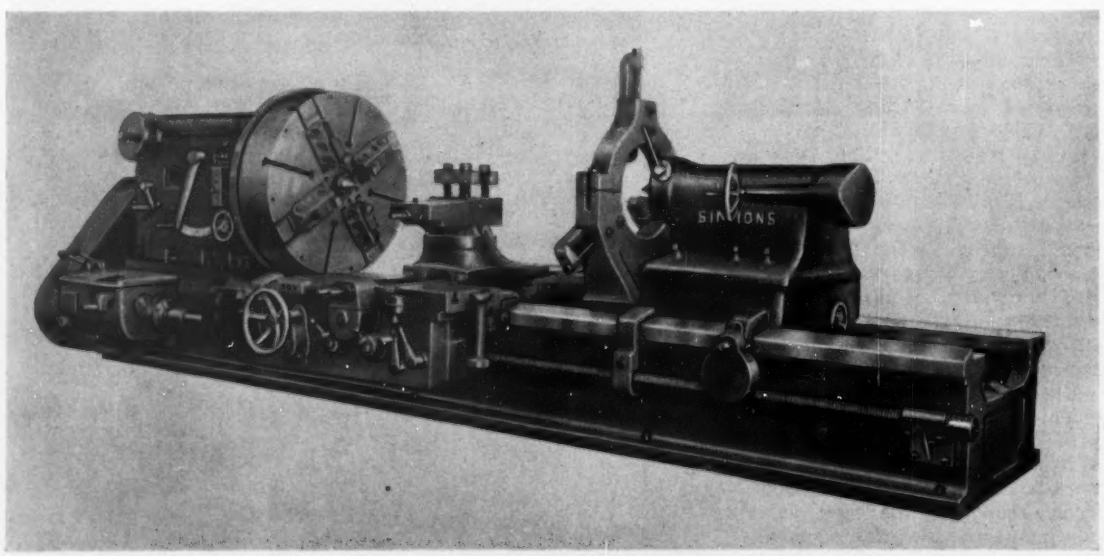
with the inside surfaces of each end. This fixture is of the hand clamping type. Production averages thirty pieces per hour, removing stock to a maximum depth of 0.020 inch on each surface. A tolerance of 0.015 inch for flatness is maintained on this job.

Simmons Redesigned Heavy Engine Lathe

The Simmons Machine Tool Corporation, 1600 N. Broadway, Albany 1, N. Y., has redesigned its extra heavy 48-inch engine lathe, giving it more power and rigidity and making it well suited for use in ordnance plants, shipyards, or any shop having heavy turning, facing, and threading work. Roll-turning and machining of shell bodies and tail shafts are examples of the kind of work for which this geared-head lathe is especially adapted. Bed lengths range from a minimum of 20 feet up to any length required, the lengths being increased in increments of 5 feet. The bed has an angular guide front way 46 1/2 inches wide.

The headstock is completely equipped with anti-friction bearings, dual Timken bearings being used on the spindle. A variable-voltage drive provides for a wide range of spindle speeds with three gear changes—two through the internal faceplate drive and one direct to the spindle. Normal spindle speeds range from 1 to 144 R.P.M. The feed gear-box provides a threading range of from 1/2 to 56 threads per inch. The lead-screw has been increased to a diameter of 3 1/2 inches, and the tailstock spindle to 7 inches in diameter.

This improved lathe is also built in 54- and 60-inch swing sizes, and can be modified to meet special requirements. A main drive motor of 30, 40, 50, or 60 H.P. can be used. Power for the carriage traverse is furnished by a 3-H.P., 1200-R.P.M. motor, and the headstock lubrication system has a 1/2-H.P., 1800-R.P.M. motor. The lathe with 20-foot bed weighs 44,000 pounds.

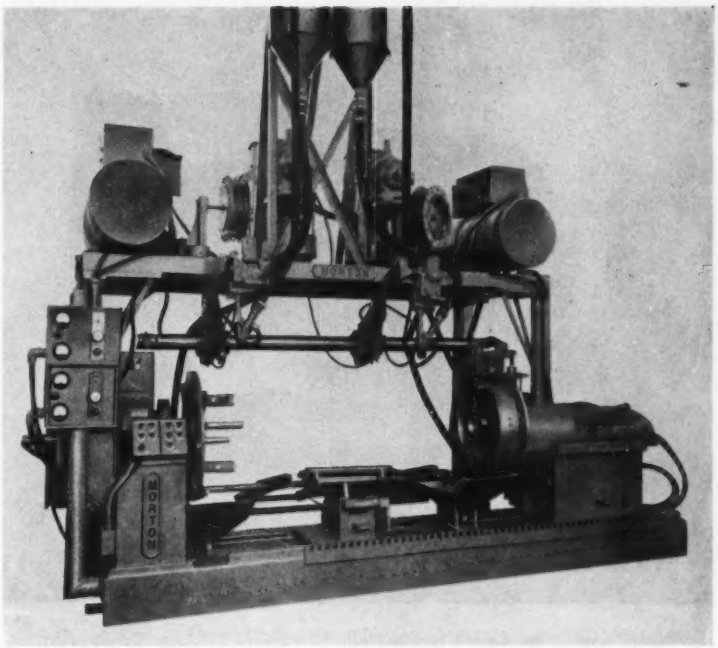


Redesigned extra heavy engine lathe announced by Simmons Machine Tool Corporation

Morton Girth Welding Machine with Built-In Assembling Press

A Model "E" press and girth welding machine designed to make fillet and burn-through circumferential welds has been developed by the Morton Mfg. Co., Broadway and Hoyt, Muskegon Heights, Mich. The main feature of this machine is a built-in 5-ton hydraulic press for use in the assembly of parts prior to welding. A two-pressure hydraulic system is employed which provides high pressure for assembling operations and low pressure for holding the parts in place during welding.

The stationary headstock supports the center spindle drive, and an adjustable tailstock houses the hydraulic press cylinder. The press is under push-button inching control, and the eject and reload cycle is automatic in operation. Manual longitudinal and radial positioning of the welding heads is provided to cover the machine range. Less than one-half hour is required to change over from one job to another. The machine is available in capacities for handling work 9 to 24, 12 to 36, or 18 to 48 inches in diameter and up to 96 inches in length.

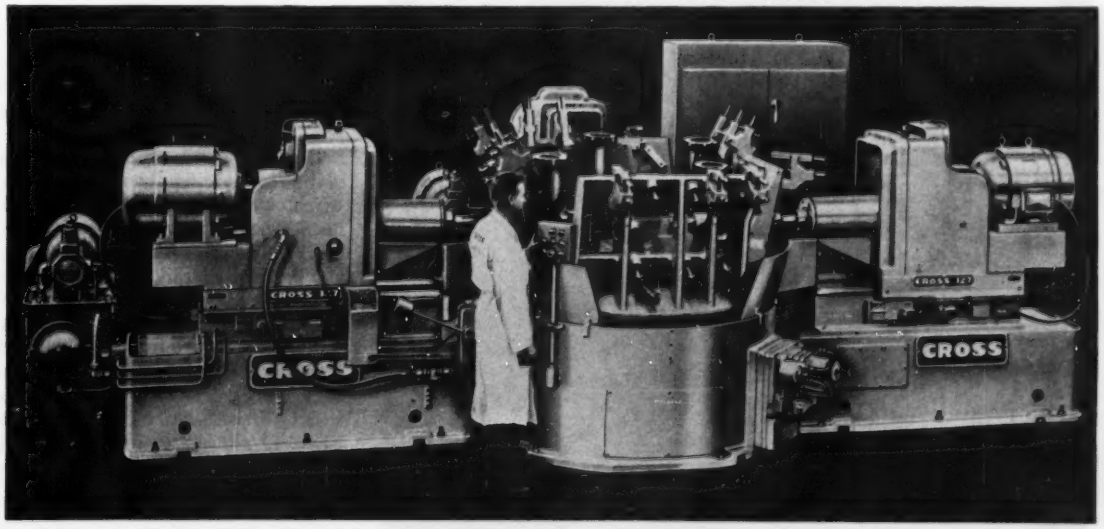


Girth welding machine with hydraulic work assembling and holding system built by Morton Mfg. Co.

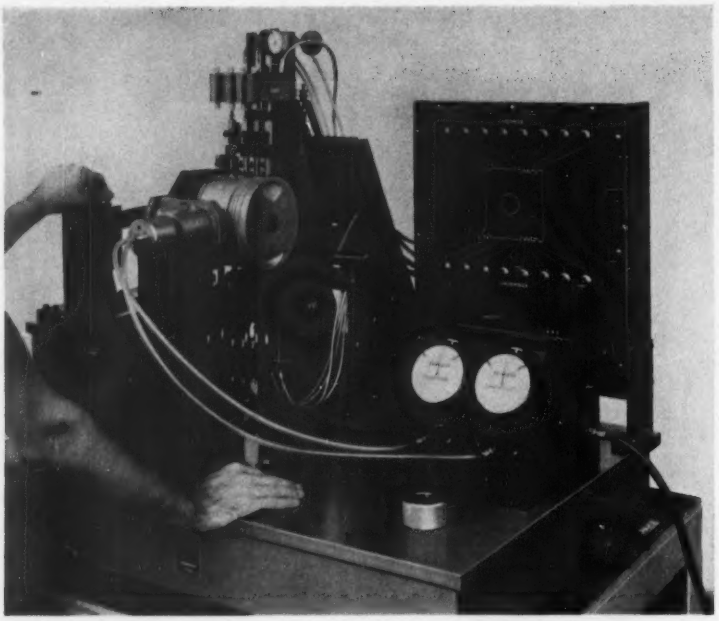
Cross Special Machine for Drilling and Reaming Tank Housings

A special machine tool for drilling and reaming tank suspension support housings has been announced by The Cross Company, Detroit 7, Mich. The housings handled on this machine are made of cast armor material having a Rockwell hardness of 42 C. Four large holes are drilled and reamed in these housings at a production rate of eleven housings per hour. The parts are held on a fluid motor-driven index-table with four stations. The first station is for loading and unloading, the second for drilling, the third for flat bottom drilling, and the fourth for reaming. Only one unskilled operator is required.

An important factor in reducing



Special machine built by The Cross Company for drilling and reaming operations on tank housings



Piston gaging equipment brought out by Federal Products Corporation

"down" time is the use of preset tools to permit quick replacement. Hydraulic and electrical construction is according to J.I.C. standards. Other features include hardened and ground ways, hydraulic feed and rapid traverse, and automatic gravity-operated cam clamping for the index-table. The use of standard Cross units facilitates maintenance and further reduces "down" time.

Federal Gage for Checking Diameters of Automotive and Aircraft Pistons

A fast, positive-operating multi-dimension gage designed to measure all critical inside and outside diameters of automotive and aircraft pistons in two simple operations has been announced by the Federal Products Corporation, 1144 Eddy St., Providence 1, R. I. With the dual-measuring air plug in a vertical position, the operator loads the piston and checks both ends of the wrist-pin hole for inside diameter, taper, and bell-mouth. The air plug is then rotated 180 degrees to explore for out-of-round and other undesirable hole conditions. The slightest variation from a master setting is immediately noted by the Federal "Dual Dimensionair" shown in the right foreground of the illustration.

As the gage handle is pushed forward, the piston takes a horizontal position between the contacts. Here all outside diameters are simultaneously inspected for out-of-tolerance by eight floating gage units, and off dimensions are shown on the "picture panel." Red lights show over size; amber, under size. These floating units are new style Federal "Electricators," which are extremely sensitive to the slightest variation in the outside diameters. They are smaller and more compact, enabling multiple gaging in close quarters.

Sheffield Small Size Precision Thread Grinder

A small precision thread grinder of radically new design has been announced by the Sheffield Corporation, Dayton 1, Ohio. This machine is specifically designed to grind threads of 20 pitch and finer, the finest pitch for which it is recommended being a 124 U. S. form thread, although finer pitches can be ground in the Whitworth form. The machine will handle work up to 1/2 inch in diameter and 4 inches in length between centers. It employs the multi-rib wheel principle used on Sheffield thread grinders for the last ten years.

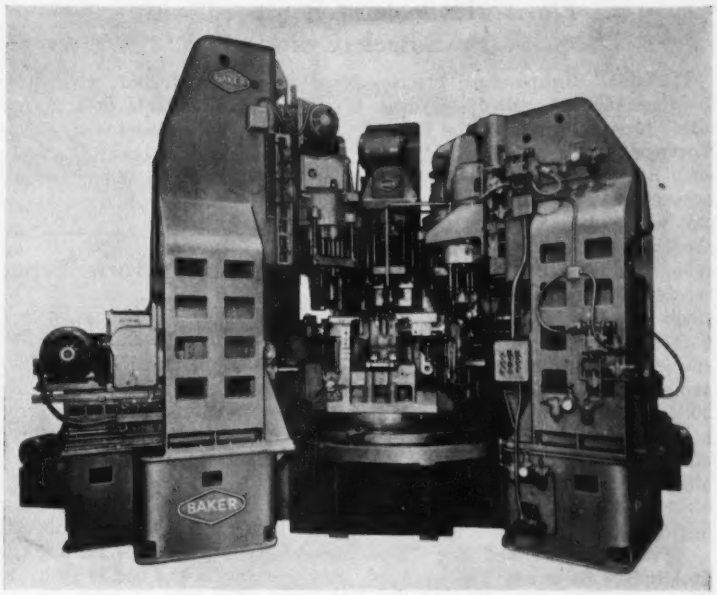
Precision small thread grinder brought out by the Sheffield Corporation

The lead-screw is driven through change-gears, making possible an easy and rapid change-over from one pitch to another. It is especially recommended for producing close-tolerance, fine-pitch threads, such as required on precision ground taps, thread plug gages, micrometer spindles, elevating and adjusting screws used in precision instruments, and similar work. This machine can be equipped with Sheffield "Crushtrue" dressing equipment for form-grinding.

Baker Special Machine for Processing Clutch Housings

Baker Brothers, Inc., 1000 Post St., Toledo, Ohio, have developed a special multi-operation machine utilizing their standard 7 1/2- by 16-inch and 15- by 16-inch units, and a 72-inch six-station power indexing table. This machine performs drilling, chamfering, boring, counterboring, and tapping operations on clutch housings at the rate of eighty parts per hour.

Units of the new machine are mounted in horizontal and angular planes. The machine has six stations, the first station being used for loading and unloading the work. Various operations are performed at the five succeeding stations. The operations include drilling holes as small as 0.257 inch in diameter and as large as 15/16 inch in diameter.

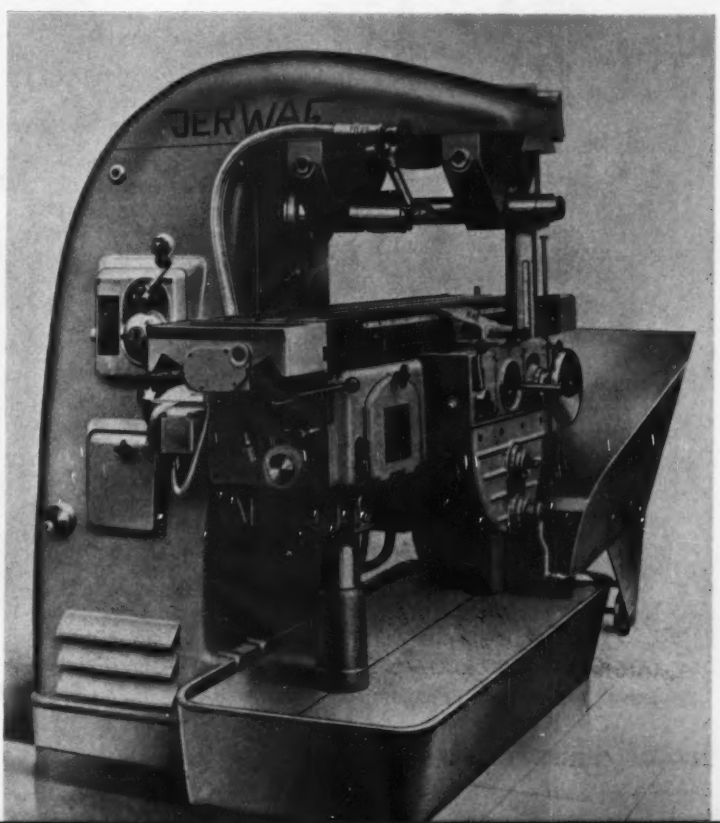


Baker machine designed to perform multiple operations on clutch housings

Machine Designed for Climb-Milling

A Jerwag milling machine, specifically designed to make full use of the advantages of the "climb" (or "down cut") method of milling without special supports or accessories, has been introduced in this country by the Kurt Orban Co., Inc., 205 E. 42nd St., New York 17, N. Y. The Jerwag machine is built to withstand the stresses and strains imposed by climb-milling at high milling feeds and speeds, the bed being especially designed to handle severe torque and torsional stresses. Special thrust absorption frames take up the forces acting on the arbor, support bearings, overarm, table, bed, and support pillars. A wide baseplate distributes pressures on the column and support pillars.

The table has a working surface 55 by 14 inches, longitudinal movement of 39 3/8 inches, vertical movement of 13 3/4 inches, and cross-feed movement of about 6 inches. The milling spindle is casehardened, and runs in ball and roller bearings. The front bearing takes up radial thrusts and a preloaded ball bearing takes up axial thrusts. A drum controller provides six speeds for the milling spindle in direct drive and six speeds through back-gears.



Jerwag milling machine introduced in this country by Kurt Orban Co., Inc.

Elmes "Hydrolair" Equipped with Push-Back Cylinders

The small, light-weight plastic-molding presses called "Hydrolairs," manufactured by the Elmes Engineering Division of American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio, are being equipped with air-operated push-back cylinders for powered ram return. These presses receive their operating power entirely from the shop air line. The particular press illustrated is a special modification of the standard design. It has a capacity of 30 tons, and is built for continuous production of molded cord and plug sets for electrical appliances, but can be modified to meet a wide range of specific production requirements.

Advantages claimed for "Hydrolair" presses are low production costs and full power operation with a high-pressure stroke, yet without the usual motors and pumps. A pre-selected pressure is automatically applied and maintained, even on compressible materials. In addition to the 30-ton model illustrated, Hydrolair presses are available in a standard 50-ton floor model with either lever or electrical control, and in 30-ton bench and floor models with lever control only.

Heavy-Duty Horn Type Press

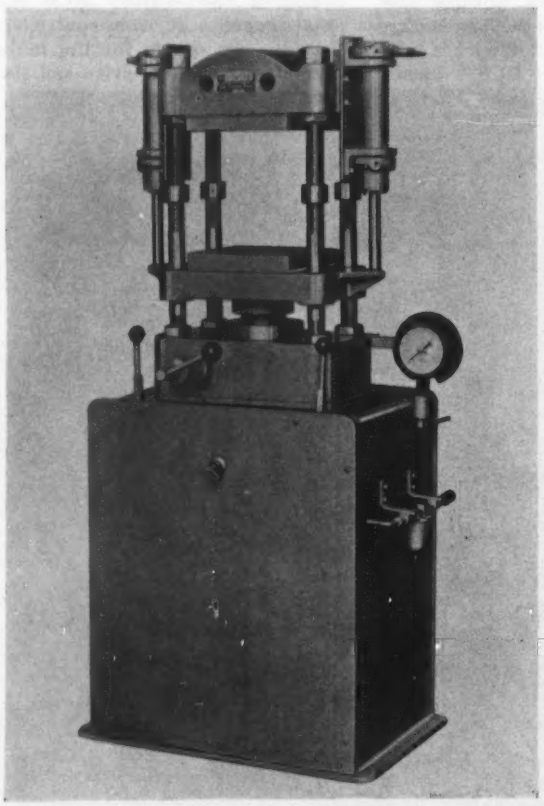
The Diamond Machine Tool Co., 5111 Coffman-Pico Road, Pico, Calif., has announced a new 40-ton horn press featuring a heavy-duty frame and easy adjustment. This press is manufactured in both plain and geared types. The shaft diameter at the main bearings is 3 1/2 inches. Bolster dimensions are 18 by 24 inches, and the opening in the bed is 10 by 14 inches. The horn is 6 inches in diameter by 19 inches long. Die height from table to ram is 6 to 18 inches, and the die height to center of horn hole is 8 inches.

The bolster has a thickness of 2 inches. Ranging from standard to maximum, the stroke is 3 to 6 inches. The ram has an adjustment of 2 inches and an area of 7 by 8 inches. The operating speed is 50 to 100 strokes a minute.

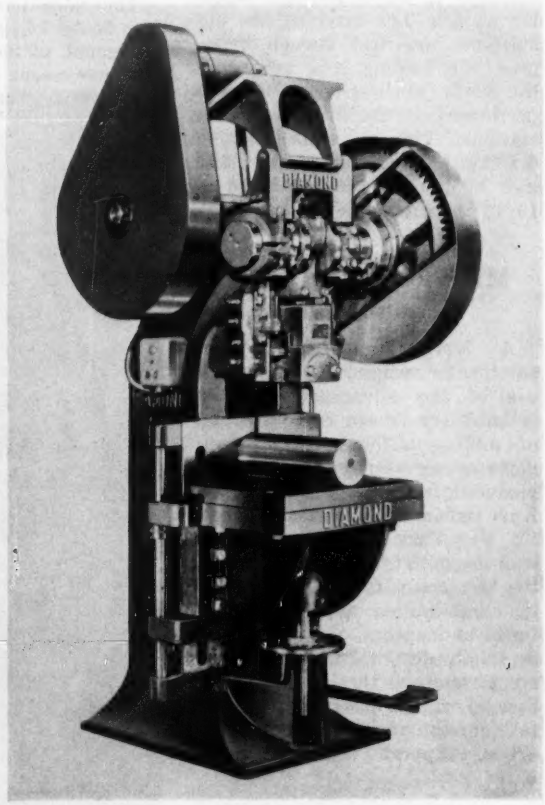
Emery Paper for Ultra Fine Finish

Emery polishing paper, No. 4/0, for producing a fine polish on metal, plastic, or wood surfaces, is being manufactured by the Behr-Manning Corporation, Troy, N. Y. It is claimed to be the finest grit sandpaper made, having over 285,600,000 particles of emery grit per square inch.

This paper is the finest of nine grit sizes of emery, and is used to remove scratches on metal and other materials which may be so fine that they cannot be seen with the naked eye. It is used in polishing needle-like parts for barometers sent up in weather balloons to record atmospheric pressure at high altitudes, and for preparing metallurgical specimens which must be checked under a microscope for structural uniformity.

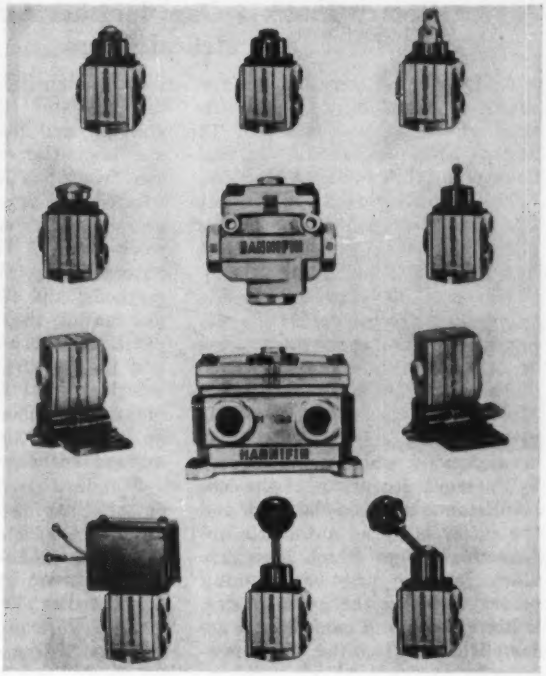


"Hydrolair" molding press fitted with push-back cylinders



Horn type press brought out by Diamond Machine Tool Co.

Precision tool grinder built by Ex-Cell-O Corporation



Hannifin pilot valves for remote control of master valves

Ex-Cell-O Precision Tool Grinder

The Ex-Cell-O Corporation, 1200 Oakman Blvd., Detroit 32, Mich., is now building a precision tool grinder known as Style 44-A. This is an entirely new double-end machine designed to sharpen modern tool materials such as sintered carbides, cast alloys, and high-speed steels. It uses 6-inch cup wheels. Because of its smoothness and true-running characteristics, the grinder is said to be especially suitable for grinding carbide with diamond wheels. It is capable of sharpening all sizes of boring, turning, and facing tools up to 5/8-inch square or equal cross-sectional area.

This machine has a heavy steel base, large U-shaped tool-rest tables which are rigidly supported, and hardened steel wear plates. The tables can be easily tilted to the exact angle required, adjustment being facilitated by a scale graduated in degrees. A coolant tank is located in the base with a large cleanout and drain opening. Other features include sturdy vibrationless construction and a wheel spindle driven by a balanced built-in motor. The spindle shaft is carried in Ex-Cell-O precision ball bearings of combination radial and thrust type having a minimum of radial and end play. The reversible motor permits grinding left- and right-hand tools on the same wheel. Cool cutting action is assured by coolant supplied from the direct motor-driven pump.

Pilot Valves for Pneumatic Remote Control of Master Valves

An assortment of ten pilot valves has been added to the line of "Pilot-Master" valves made by the Hannifin Corporation, 1110 S. Kilbourn Ave., Chicago 24, Ill. These valves can be employed for either two- or three-way, normally closed or normally open to pressure service. They are designated Series C, and are regularly furnished only in 1/4-inch pipe size.

The valves can be used either for the direct control of small air cylinders and other air-operated devices or for the remote control of larger units. One pilot valve can be installed to operate two or more master valves or, in more complicated all-pneumatic circuits where cam-operated pilot valves operate like limit switches, there may be several pilot valves operating one master valve.

Basically the same three-way, direct-operated, poppet type valve mechanism is used in all ten pilot valves. Operating heads to suit a wide range of applications are available, including solenoid, ball, cam, palm-button, piston, and pressure-operated types.

Improved "Hy-Pro" Machine Screw Taps

Improved "Hy-Pro" machine screw taps designed for special work by the Hy-Pro Tool Co., New Bedford, Mass., include four types: No. 510-5, for tapping plastics, has five flutes and a finish known as "Hardernell"; No. 510-3, for tapping aluminum and zinc die-cast metals, has three flutes; No. 511, for tapping aluminum and zinc die-cast metals, has two flutes and a spiral point; and No. 315, for tapping alloy steels, has a spiral point and Ferrox finish. The taps have a pitch diameter which is 0.0025 inch over size. They are available in 6-32, 8-32, 10-24, and 10-32 standard sizes.

A spiral point, stub flute hand tap with Ferrox finish, made in fractional sizes from 1/4 to 1/2 inch in both National Fine and National Coarse thread types, has also been introduced.

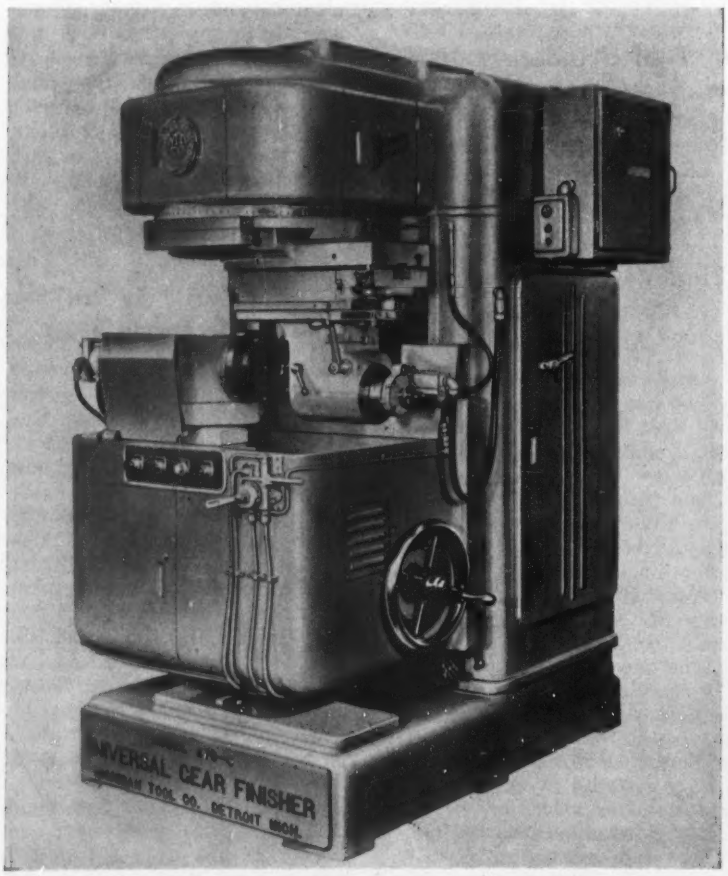
Rotary Internal Gear Finisher for Spur and Helical Gears

A Model 870-C gear finisher for spur and helical internal gears in sizes up to the equivalent of 12 inches outside diameter is announced by the Michigan Tool Co., 7171 E. McNichols Road, Detroit 12, Mich. Internal gears having pitch diameters as small as 4 inches can also be finished.

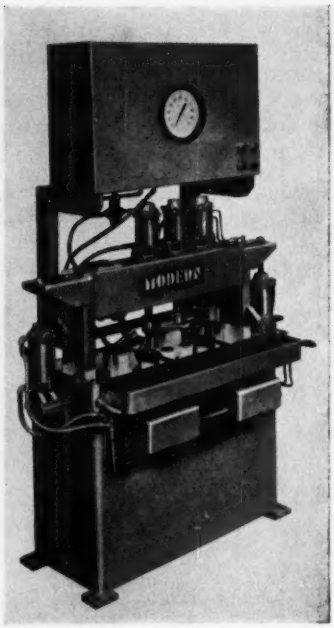
The machine operates by the transverse (reciprocating) shaving method that permits the use of a relatively narrow serrated-tooth cutter. The cutter is reciprocated across the face width of the internal gear in a crossed axis arrangement while being driven by the work. Reduction of the center distance between the work and the cutter is by an automatic up-feed mechanism which also provides for one or two finishing passes to bring the gear to size.

Plunge shaving can also be accomplished by adding a plunge-feed mechanism. This method is much faster than conventional shaving, and uses a serrated-tooth shaving cutter which is wider than the work. The work-piece is rotated and drives the cutter. No reciprocation occurs while the work-piece is being fed upward automatically. In both shaving methods, up feed is completely automatic, the work being fed until the correct size is reached and then returned to the loading position. Machines having the plunge-feed mechanism can also be operated by the transverse method without alteration.

Standard cutter spindles use cutters having pitch diameters from 3 to 6 inches. The maximum stroke of the head is 5 inches and the maximum gear face width is 4 3/4 inches. The coarsest recommended work pitch for this equipment is 5 diametral pitch.



Internal gear finisher made by Michigan Tool Co. for transverse or plunge shaving of internal spur and helical gears



Pressure testing machine made by Modern Industrial Engineering Co. to locate leaks in manifolds

Pressure Testing Machine for Detecting and Locating Leaks in Castings

A pressure testing machine that detects and locates leaks in gas passages in cast-iron automotive engine exhaust manifolds is announced by the Modern Industrial Engineering Co., 14230 Birwood, Detroit 4, Mich. Manifolds to be checked are manually loaded into the testing area of the machine, where the exhaust gas areas are sealed in three planes by rubber-faced, air cylinder-controlled sealing pads. The resulting pressure build-up in the control circuit when the pads contact the manifold starts an automatic air test cycle. The manifold is then charged with a specific volume of air in the gas areas.

Pressure loss over a given preset test time is indicated by a gage in the head of the machine. Leaks that show excessive pressure loss are located by immersing the manifolds in a built-in illuminated water tank. The tank is finished with a special paint that provides maximum reflection of light on the work, which is raised from the immersion test by the use of air cylinder controls. Areas to be impregnated to stop leaks are marked with chalk.

Combination Forming and Welding Machine

A combination forming and welding machine has been developed through the joint efforts of the Struthers Wells Corporation, Titusville, Pa., and the Federal Machine & Welder Co., Warren, Ohio. Machines are now being produced to form and weld a wide range of appliance cabinets and liners. The machine consists of a Struthers Wells "Quadruplex" tangent bender with a Federal welding component mounted on a beam which is raised and lowered with each machine sequence for the forming operation.

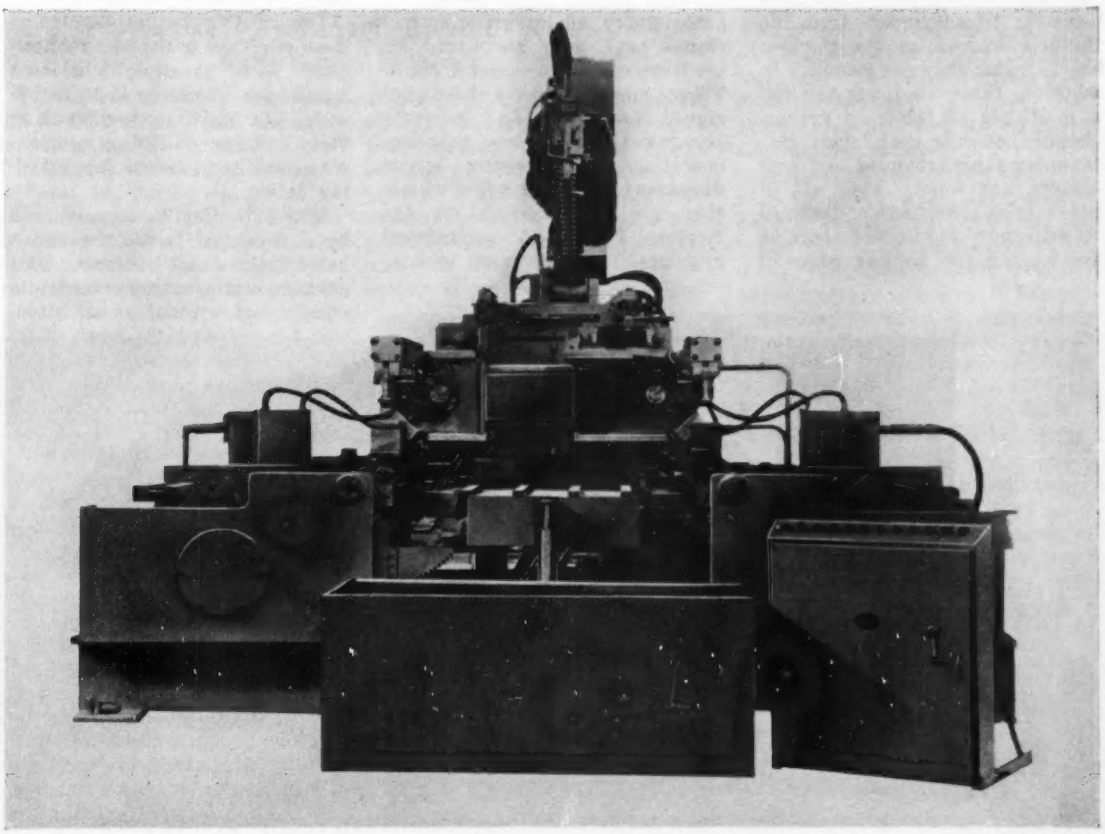
The material is first placed in the lower dies of the bending machine. The operator then presses a button to start the fully automatic forming and welding cycle. The bender forms the cabinet to the desired shape, the last bending operation actuating a limit switch which initiates the automatic welding cycle. At this point, the welder beam is lowered and automatically latched to the male bender die. The welding guns then engage the cabinet and make the welds. When the guns retract, the beam is unlatched and raised to the dwell position. At the time that the welding beam starts to retract, the bending wings of the tangent bender also return to their initial position. The cabinet assembly is then automatically lifted to a position where it can be easily unloaded.

With this machine only one operator is required to perform both operations of forming and welding. Since the weld is made while the material is held accurately to size in the bender, there is no need for over forming, thus eliminating sizing fixtures. The welding component shown in the illustration is designed with a series welding circuit, the series die being incorporated in the male die of the bender. For heavy gages, direct welding is used. Units have been designed in which the welding guns are indexed. Thus the spacing on any series circuit can be enlarged to suit conditions.

Gap type electrically powered hydraulic press

Dake Gap Type Hydraulic Presses

A complete line of electrically powered hydraulic gap type presses for forcing and straightening operations is being placed on the market by the Dake Engine



Bending and welding machine developed jointly by Struthers Wells Corporation and Federal Machine & Welder Co.

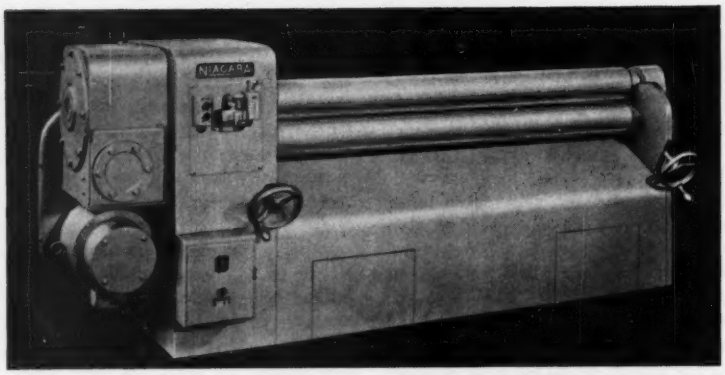
Co., 604 Seventh St., Grand Haven, Mich. These presses are now available in eleven standard forcing models and eleven standard straightening models with capacities ranging from 15 to 300 tons.

The straightening presses have a self-contained power unit and adjustable stroke control for both directions of stroke. A combined hand- and foot-lever provides sensitivity which permits the operator to apply any pressure up to the maximum by merely increasing pressure on the control valve.

The forcing presses have a two-speed ram advance and an extra large table, permitting their use for a wide variety of operations. The stroke can be pre-set for both directions by an adjustable-stroke limit cam. Semi-automatic or automatic cycling can be provided.

All-Steel Bending Rolls

A new series of all-steel bending rolls has been announced by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo 11, N. Y. These bending rolls are designed to produce commercially true cylinders from the thinnest as well as the thickest sheets which they can handle. In addition, these machines can roll a multitude of bends in various shapes including oval forms, rectangular pipes, rounded end containers, and cones. They are of pinch type construction designed to materially reduce flat spots on the leading and trailing edges of the work. As all three rolls are power-driven, light-gage sheets can be formed to small diameters.



All-steel bending roll announced by Niagara Machine & Tool Works

An air-operated drop end is controlled by a two-position valve. The upper roll is arranged to tilt automatically to facilitate removal of the rolled cylinder. Power adjustment for the rear roll allows the operator to quickly move the roll to the proper position for producing any desired radius of curvature. Indicators permit speedy duplication of roll settings for repeat jobs. The rolls are made in three sizes, with capacities of 5/16 by 48 inches; 3/16 by 72 inches; and 12 gage by 120 inches.

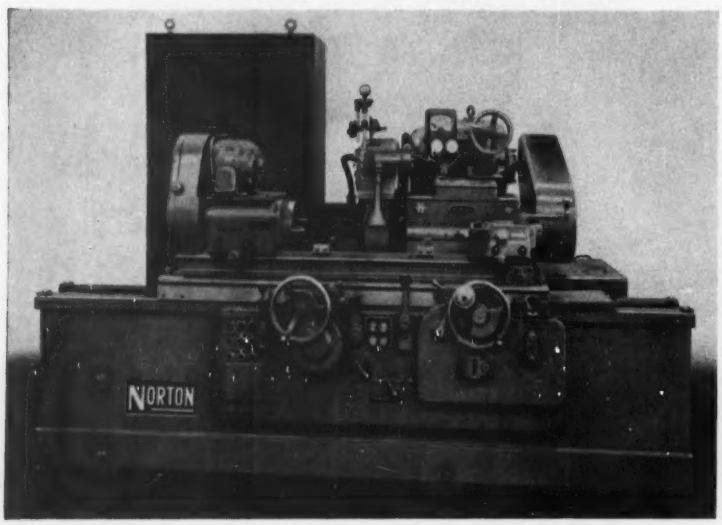
Norton Plain or Semi-Automatic Cylindrical Grinders

Heavy-duty 10-inch Type CTU-HD and 14-inch Type LCTU-HD automatic cylindrical grinding machines have been announced by the Norton Co., Worcester 6, Mass. These machines have been designed for rapid and accurate plunge-cut and traverse grinding operations that require larger diameter or wider grinding wheels than are accommodated by the Norton Type CTU cylindrical grinders. They are made in four bed sizes covering a work length range of 18 to 72 inches.

The most important feature of these machines is the heavy wheelhead with pressure-lubricated spindle for wheels up to 10 inches wide. The rigid work-supporting units and smooth-sliding components combine to assure fast grinding action.

Wheel feeding is accomplished by a revolving feed-screw which has a "click-count" feature. This permits settings to be made instantly and without visual attention for reducing the work diameter by increments of 0.0001 inch. Provision is also made for presetting the truing and grinding table speeds which permits immediate selection thereafter of either speed by movement of a combination table start-stop and selector lever. Continual resetting of these speeds is thus avoided.

Work jogging control is obtained by means of a conveniently positioned hand-lever. Operation is simplified by automatic control of work rotation and coolant flow; by automatic adjustable wheel feed at table reversals; and by resetting of the wheel-head. Separate dwell controls for each end of table travel are also furnished. The semi-automatic machine is designed for high output on plunge-cut jobs.

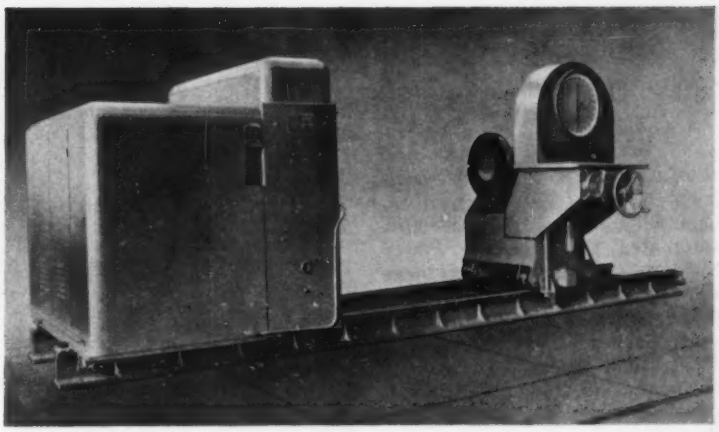


Heavy-duty cylindrical grinding machine developed by the Norton Co.

Torsion Machine for Testing Joints on Oil-Well Drill Pipe

A torsion machine with unusual design features has been built by the Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa., for the testing of tool joints on oil-well drill pipe. The machine measures torque in either direction of twist, and has two open chucks which permit running drill pipe of any length and size up to 10 1/4 inches through it. This machine is to be used solely for screwing up and unscrewing tool joints such as is done on rotary drilling rigs when hoisting the drill stem and returning it into the well. The capacity of the machine is 600,000 inch-pounds in either direction with 500 inch-pound graduations on the indicator dial. A lower range of 120,000 inch-pounds is indicated by 100 inch-pound graduations.

Torque is applied in two speed ranges: from 1 to 6 R.P.M. for screw-up approach and from 0 to 1 R.P.M. for "bucking up" the tool joint. A slipping clutch is provided because of the rapid load rise when shoulders of the joint meet. Distance between chucks may be set anywhere between 4 and 100 inches by moving the control and indicator cabinet on its track. The over-all length of the machine is 22 feet.



Torsion machine for testing tool joints on oil-well drill pipe, brought out by the Baldwin-Lima-Hamilton Corporation

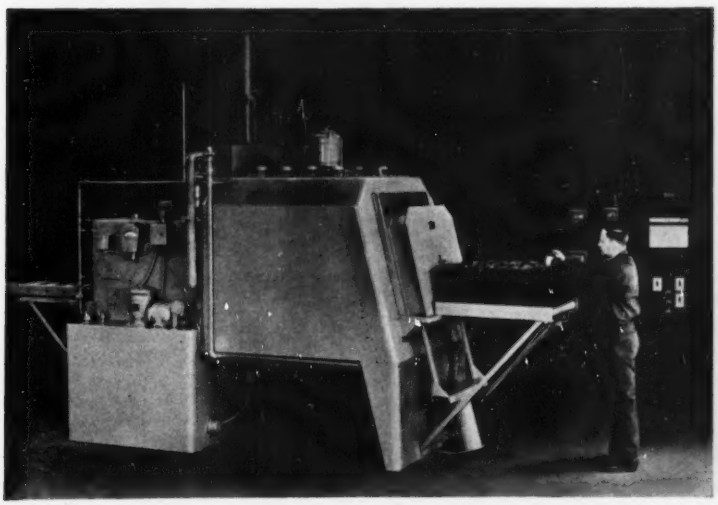
Ipsen Heat-Treating Unit with Forced Convection Heating

A heat-treating unit developed for both small-lot and production runs and for a wide range of processes has been announced by Ipsen Industries, Inc., 715 S. Main St., Rockford, Ill. This automatic heat-treating unit has forced convection heating and operates at temperatures up to 1850 degrees F. It has an automatic straight-through operating cycle from heating to cooling or oil quenching. The unit is sealed to provide absolute atmosphere control during the entire heating and quench cycle, assuring bright, scale-free work for all types of heat-treating processes—carburizing or carbonitriding, for example. The T-400 unit, as this equipment is called, has a capacity for handling 400 pounds of work per hour.

The forced convection heating system employs non-alloy radiant heating tubes, baffles, and a fan mounted in the roof of the furnace. The tubes are spring-loaded and sealed by means of compression bellows, and are designed for either gas-fired or electric heating elements. The heating tubes are mounted vertically between the brick insulation and an interior demountable baffle.

Work is loaded directly into the heating zone. After the proper heating period, the work tray is transferred to a quench-cool rack which holds the load for atmosphere cooling, or lowers it for oil quenching, whichever has been pre-selected on the cycle control panel. As soon as the tray is on the rack, a new load can be put into the heating zone. The work tray is automatically moved from the heating zone to the quench zone by an Ipsen cold-chain transfer mechanism.

If the work is to be atmosphere-cooled, the cycle control maintains the rack in a raised position above the quench tank. Once set, the cycle automatically controls the time, temperature, and work movement through heat, quench, or cooling. Changeover from one process to another is easily accomplished. The unit is used to normalize, stress relieve, harden, carburize, carbonitride, and braze. It can be supplied with a special insulated tank for martempering or hot oil quenching.



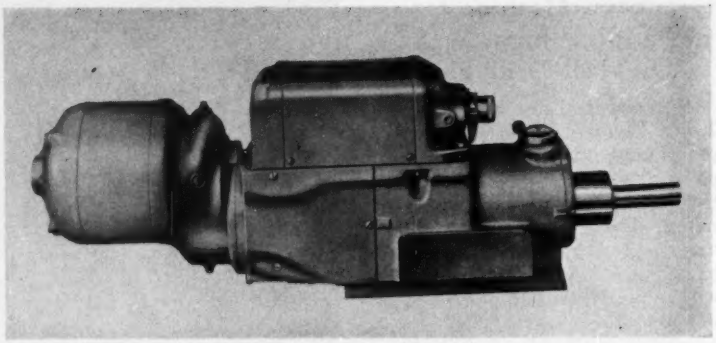
Versatile heat-treating unit brought out by the Ipsen Industries, Inc.

Power-Operated Machine for Notching Sheet Materials

A power-operated machine for notching sheet material has just been announced by the O'Neil-Irwin Mfg. Co., 558 Eighth Ave., Lake City, Minn. This machine, designated the "Di-Acro Power Notcher," will cut notches as large as 6 by 6 inches in 16-gage sheet steel. Notches having included angles larger or smaller than 90 degrees can be cut by making a few simple adjustments. Straight shearing work can also be performed.

The machine is designed for operation on high-speed production work at rates up to 180 strokes per minute. Minimum operator fatigue, an important factor on long production runs, is a feature claimed for this machine. The foot-actuated clutch leaves the operator's hands free for work-handling. Single-stroke action of the clutch prevents accidental work damage.

The drive to the flywheel is by either a single or three-phase 1/2-H.P. electric motor. Danger from exposed moving parts is eliminated and greater work visibility made possible by housing all moving parts in a steel cabinet. The work table is 12 by 18 inches.



Delta hydraulic drill unit with single-reduction geared-head motor drive

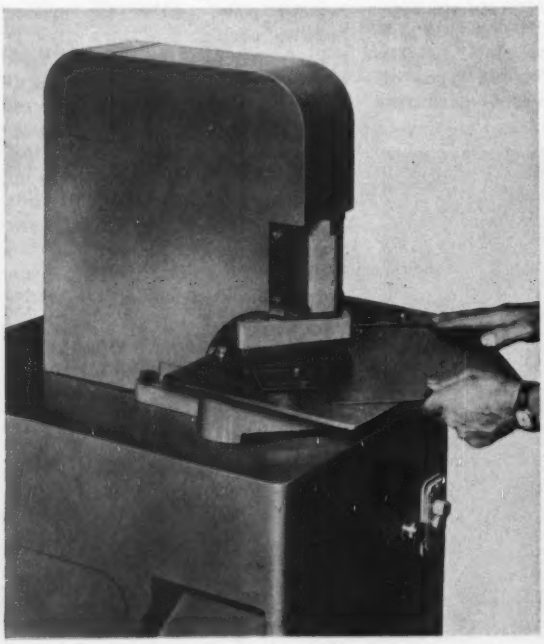
Delta Air-Powered Hydraulic Drill Unit

An air-powered hydraulic drill unit has just been added to the line manufactured by the Delta Power Tool Division, Rockwell Mfg. Co., Dept. DH-H22, 400 N. Lexington Ave., Pittsburgh 8, Pa. This No. 19-600 unit is designed for heavy-duty drilling, tapping, reaming, spot-facing, and hollow-milling, or similar operations. Features include quick set-up; versatile hydraulic feed control; and fast traverse to positive stops.

The unit has a maximum stroke of 6 inches and an 1800-pound thrust when operated by air at a pressure of 80 pounds per square inch. The length of stroke is controlled by means of a positive micrometer stop that is infinitely adjustable from 0 to 6 inches. Holes can be drilled to exact specified depth within 0.0005 inch. Rapid approach is at a maximum rate of 5 inches per second with infinite adjustment in length up to the full stroke of the unit. The rapid return stroke has a maximum rate of 4 inches per second.

Universal Tool and Cutter Grinder

A universal tool and cutter grinder, known as the Sterling Model "G," has just been introduced by the McDonough Mfg.



"Di-Acro" power-operated sheet-metal notching machine

McDonough universal tool and cutter grinder

Co., Eau Claire, Wis. This machine is completely new from the cast base, which is designed to dampen vibration, to the direct drive wheel-head. The wheel-head rotates through 360 degrees and the work-table swivels through 180 degrees. The swing over the table is 10 3/4 inches, and the maximum distance between centers is 27 inches. A work-head with No. 12 Brown & Sharpe taper and No. 50 milling machine taper is standard equipment.

The machine can be operated from the front or either side. It is available in both plain and universal types. The plain machine will handle most of the tool and cutter grinding in any shop.

Rotex Bench Milling Machine

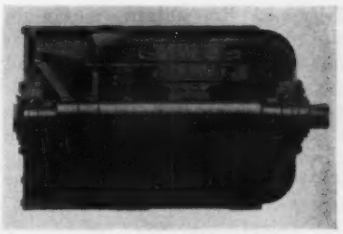
A compact bench milling machine of sturdy design, said to handle heavy work ordinarily requiring the use of larger machines, is now available from the Rotex Punch Co., 4726 E. 12th St., Oakland, Calif. Work requiring 12-inch longitudinal, 9-inch vertical, and 5-inch transverse travel movements is readily handled on the 5- by 20-inch table.

The large-diameter spindle is supplied with a No. 10 Brown & Sharpe or No. 4 Morse taper, and can be operated at fifteen separate forward or backward speeds. The spindle is equipped with Timken bearings. All ways are of the dovetail type and are hand-scraped. The work is power-fed at rates of 0.003, 0.006, or 0.012 inch per spindle revolution.

G-E High-Slip Motor

A totally enclosed, fan-cooled, high-slip induction motor, designed for use in acceleration of high-inertia loads such as imposed by punch presses, centrifuges, hoists, etc., has been announced by the Small and Medium Motor Department of the General Electric Co., Schenectady 5, N. Y. This motor, designated as Type KRX, is 30 per cent smaller and 40 per cent lighter than conventional motors in the same class.

In this motor, low-resistance rotor bars are extended on one end and pass through a rotating baffle plate. Beyond the baffle plate, the bars are brazed to strips of high-resistance metal, shaped to form a radial-blade fan, the blades of which provide the higher rotor resistance necessary for high-slip characteristics. Thus, most of the rotor heat develops where there is a direct transfer to the cooling air outside the motor enclosure.

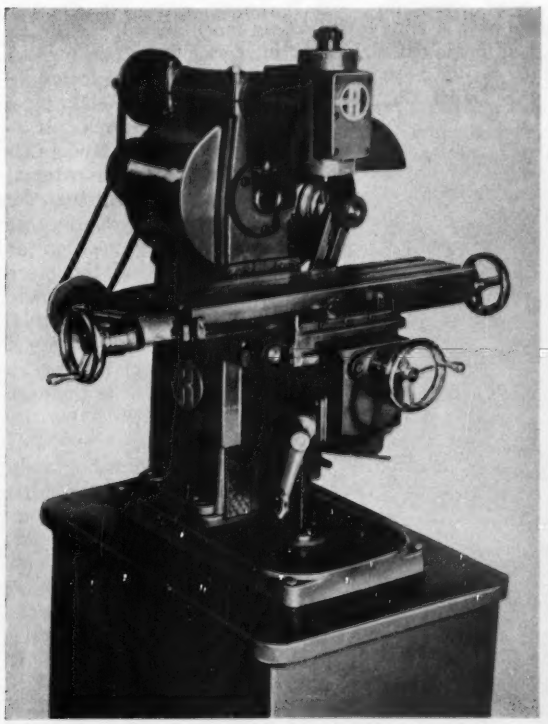


Cut-away view of totally enclosed high-slip induction motor developed by General Electric Co.

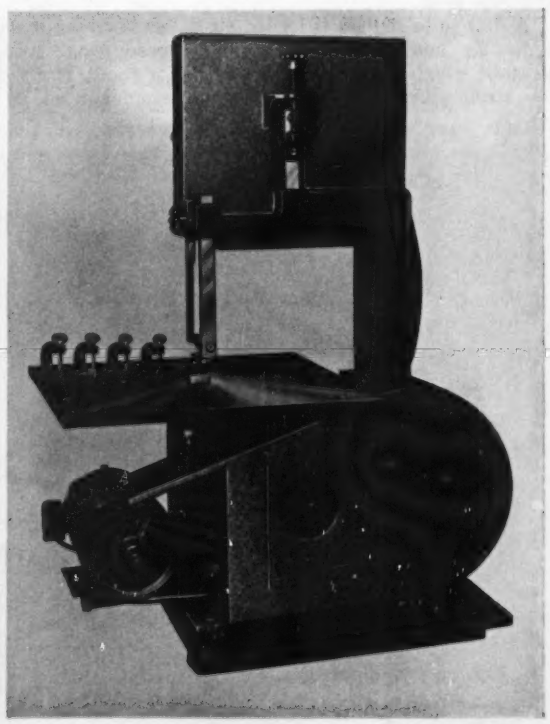
This new motor is now available in power ratings of 30 to 150 H.P. at 900 and 1200 R.P.M., 5 to 8 and 8 to 13 per cent slip, respectively. Voltage ratings are 220, 440, and 550.

Bett-Marr Sheet-Metal Band Saw

The Bett-Marr Co., Hopkins, Minn., has just brought out an improved, heavier model sheet-metal saw with an all-cast frame



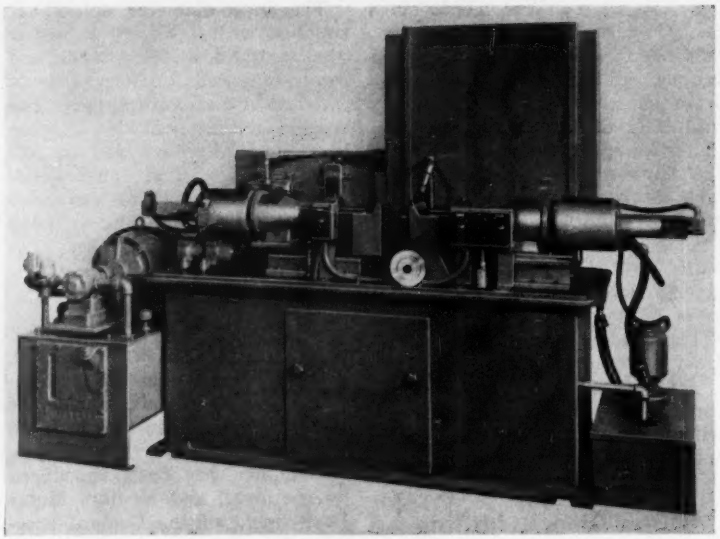
Bench milling machine marketed by the Rotex Punch Co.



Sheet-metal band saw brought out by the Bett-Marr Co.

developed to obtain maximum stability and accuracy with a minimum of vibration. This saw will cut fifty to seventy stacked galvanized metal sheets at speeds up to 15 inches per minute. It is an all-purpose 14-inch ball-bearing band saw, with blade speeds ranging from 125 to 2200 feet per minute, quickly adjustable for cutting metal, plastics, wood, iron and steel castings and forgings, and other materials without blade chatter. The 20- by 22-inch table permits handling of large work.

Complete equipment includes a set of four sheet metal clamps and a riser bar insert for cutting stacked sheet metal. Attachments are available for precision circle-cutting and for longer than throat depth cutting.



Disc drilling and deburring machine brought out by the Govro-Nelson Co.

High-Speed Disc Drilling and Deburring Machine

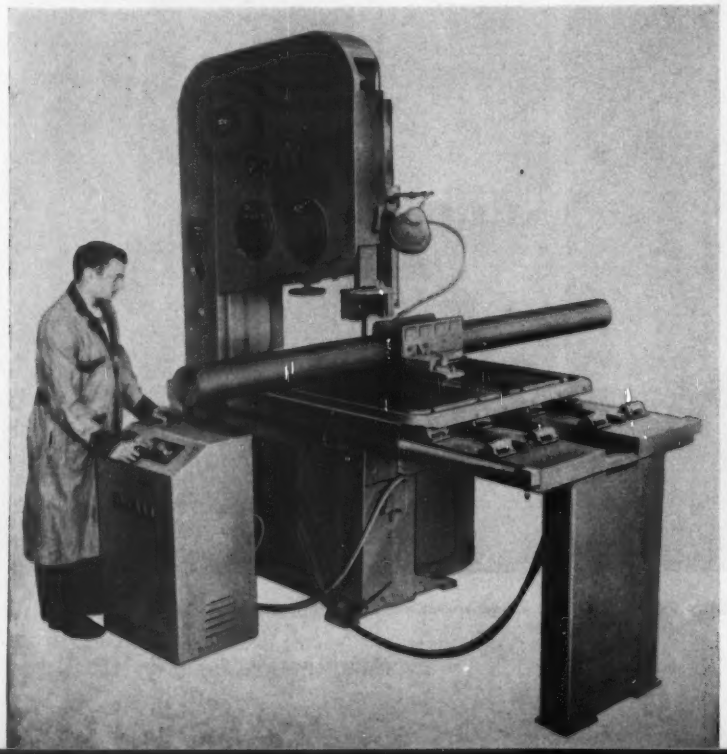
A new electrically interlocked machine which drills and deburrs six holes in a steel disc at the rate of approximately 260 pieces per hour has recently been announced by the Govro-Nelson Co., 1933 Antoinette, Detroit 8, Mich. The machine incorporates two Govro-Nelson automatic drilling units, each equipped with a six-spindle multiple head.

A disc to be drilled is loaded on a locator and a start switch is pressed which causes the part to be automatically clamped. One unit then feeds in automatically to drill six 3/32-inch holes, whereupon the second unit feeds in automatically from the opposite side to deburr the six holes. When the deburring unit completes its operation, the part is automatically unclamped so that the machine is ready for reloading. Different multiple heads can readily be adapted to other drilling and deburring operations.

Band-Sawing Machine Designed for Heavy-Duty Cut-Off Work

An unusually large capacity band-sawing machine with a wide speed range designed principally for rapid, heavy-duty cut-off work is announced by the DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill. This machine will handle all kinds of ferrous or non-ferrous metals and all shapes including plate, structural, ingot, slab, pipe, extruded, or rolled forms. It is designated the "Zephyr Model CO-36," and differs from conventional band-sawing machines in that the saw blade is twisted 90 degrees from the customary position at the work-table so that the piece to be cut off is fed to the blade from the front of the machine. Consequently, the length of stock that can be cut is not limited by the throat capacity, as is the case when work must be fed from the side of the machine.

The machine, however, is readily convertible to conventional high or low speed, straight or contour sawing. The saw guides are simply changed to eliminate the twist from the blade and the table is moved into a "neutral" position. This machines handles both very long and very heavy pieces. It



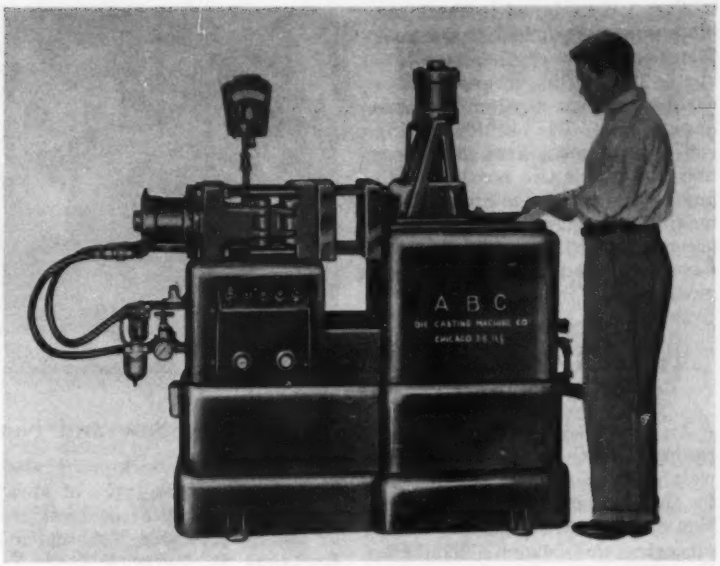
DoAll band-sawing machine built to cut off long, heavy metal shapes and bars

takes work 15 1/2 inches thick under the saw guides and 9 1/2 inches thick at the column. The 40- by 48-inch work-table is hydraulically powered and is capable of handling work up to 2000 pounds in weight.

Any speed is obtainable from 40 to 10,000 feet per minute. A movable remote control unit enables the operator to stand at a point of vantage during operations on long or bulky pieces. Saw bands up to 1 1/4 inches wide may be used.

Die-Casting Machine

The A B C Die Casting Machine Co., 339-41 W. 112th Place, Chicago 28, Ill., has just added a die-casting machine to its line for zinc castings weighing up to 1 1/2 pounds. Outstanding features of the machine are its electronically controlled panel, 10- by 10- by 2 1/2-inch die-blocks, four tie-bars, and semi-automatic cycling with adjustable timing dwell on opening and closing of the toggle. The machine is air-operated, and is capable of a free cycling speed in excess of 1000 shots per hour.



Zinc die-casting machine brought out by A B C Die Casting Machine Co.

P & W Air-O-Limit Gages for Root Forms on Jet Blades

Two gages designed to speed up the checking of external and internal pitch diameters of the root forms on jet-engine blades and blade carriers have been developed by Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford 1, Conn. Both units are used as hand gages in conjunction with a standard P & W Air-O-Limit Model "F" comparator, as shown in Figs. 1 and 2.

The blade root gage seen in Fig. 1 incorporates a carbide roll type anvil which is adjustable to accommodate various sizes of root forms. The gaging point opposite the roll type anvil is a carbide ball-point spindle which operates the single air nozzle. A carbide roll pressure shoe spans the gage point and provides positive location of the gage on the blade root during the gaging operation. Prior to the installation of this Air-O-Limit equipment, pitch diameters of fir tree root forms were checked by the relatively slow method of using hand micrometers and thread measuring wires.

The blade carrier gage shown

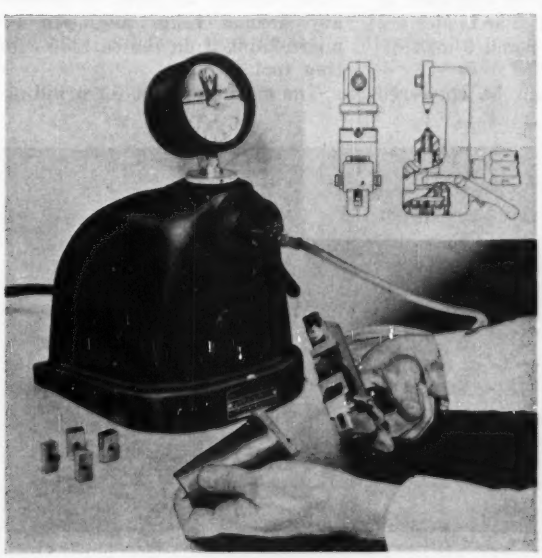


Fig. 1. Jet-blade root gage with P & W comparator

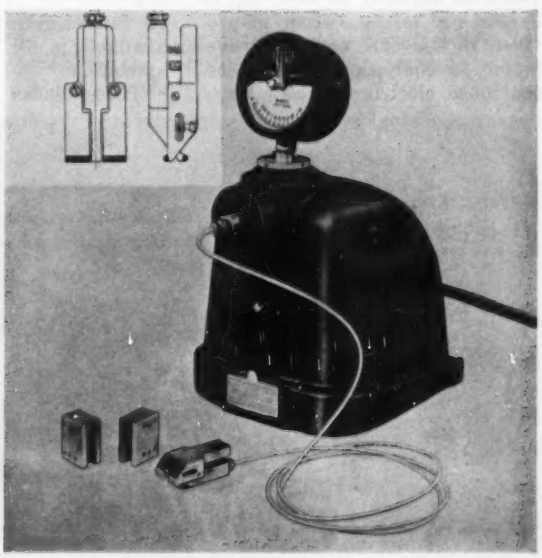


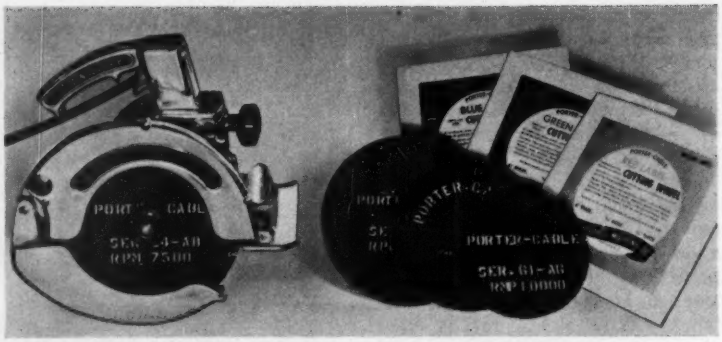
Fig. 2. Carrier gage installed on another comparator

in Fig. 2 is designed to check the pitch diameter of the internal root forms in the jet-engine blade carrier. The design incorporates a carbide roll type anvil and carbide gaging roll. The carbide gaging roll is on a pivot arm that operates the single air nozzle. Both gages are set to minimum and maximum masters. (The diagrams accompanying the illustrations have the carbide gaging points or anvils shown in heavy black.)

Tramrail Carrier with Hydraulic Scale

An overhead traveling carrier equipped with a hydraulic-cell weighing scale has just been built by the Cleveland Tramrail Division of the Cleveland Crane & Engineering Co., 5426 E. 282nd St., Wickliffe, Ohio. This scale permits quick, easy weighing of all loads handled. The hydraulic cell (not visible in the illustration) is operated by a lever to which is fastened the upper hoist block. Resulting pressure is transmitted from the cell to the scale dial by hydraulic tubing. The scale weighs in either pounds or kilograms.

The motor-driven carrier has a travel speed of 300 feet per minute. Hoisting speed is at the rate of 38 feet per minute, and the lift height is 36 feet. Both travel and hoisting motors are provided with variable-speed controllers. In addition, the hoisting controller is designed for dynamic lowering. The load capacity of this unit is 3 tons. A safety switch is provided in the cab, and the travel motor is equipped with a foot-controlled electric brake.



Porter-Cable kick-proof electric saw and three new types of abrasive cutting blades

Kick-Proof Saw and New Types of Abrasive Blades

A high-speed, kick-proof electric saw and three types of abrasive blades have been developed by the Porter-Cable Machine Co., Exchange St., Syracuse 8, N. Y., to enable the user to easily select the correct type of abrasive blade for cutting any particular material or substance. The three blades are marked in three different colors to designate their respective uses.

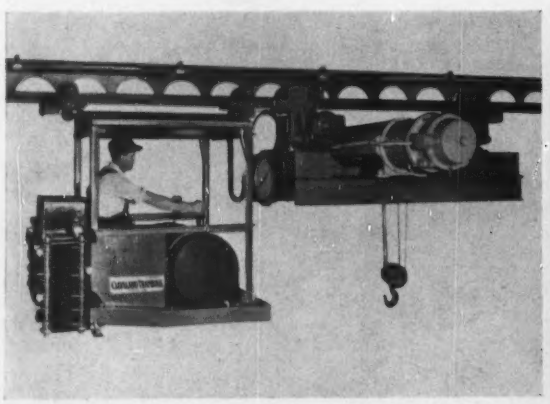
Red Label blades cut compositions such as Transite, asbestos siding, Masonite, fiber board; and non-ferrous metals such as aluminum roofing, copper gutters, zinc flashing, bronze pipe, and similar materials. Green Label blades cut all stone substances including concrete or cinder block, brick, tile, marble, granite; and plastic materials such as Lucite and Bakelite. Blue Label blades are reserved for iron and steel in its various forms. The blades are available in 6-, 7-, and 8-inch diameters.

These blades can be employed on any electric saw, but are especially recommended for use with the Porter-Cable "Speedmatic" or "Guild" saws because of their high speed and the kick-proof clutch which permits the blade to stop instantly in the event that it becomes jammed. This feature protects the operator from injury and prevents damage to equipment.

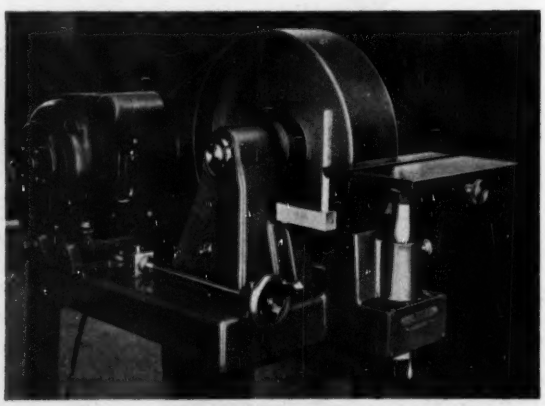
Abrasive-Belt Grinder for Sharpening Carbide Tools

A Model 13 "Micro-Finisher" designed for sharpening carbide-tipped tools is being manufactured by the Fenlind Engineering Co., 5602 Pike Road, Rockford, Ill. The machine is provided with a waterproof silicon abrasive paper belt called "Speed-wet Durite." The height of the worktable can be adjusted to permit any normal relief angle to be micro-finished on the carbide cutting tool.

The machine is set for grinding



Carrier with weighing scale announced by Cleveland Tramrail Division, Cleveland Crane & Engineering Co.



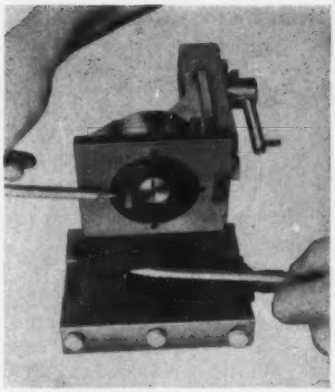
"Micro-Finisher" brought out by Fenlind Engineering Co., for use in sharpening carbide tools

the desired relief angle by adjusting the height of the table until the face of the cutting tool contacts the belt on the periphery of the belt contact wheel at a point on its curvature that corresponds to the relief angle desired. A vertical gage marked in degrees from 1 to 22 is accurately mounted near the table at the left of the wheel. Proper table height is established for a specified relief angle by aligning the cutting edge of the carbide tip with the correct angle marking on the vertical gage.

Carbide-tipped tools are first rough-ground to the required clearance angle with a silicon-carbide grinding wheel. The tools are then finish-ground on the new belt machine with the table set to produce the correct relief angle. The tool is given a micro-finish on both front and side relief angle surfaces and on the nose angle by swinging the tool through approximately a 90-degree arc.

Manual Gun for "Aircomatic" Welding

Model No. 20 "Aircomatic" gun developed for manual inert-gas shielded-metal arc welding announced by Air Reduction, 60 E. 42nd St., New York 17, N. Y. This manual gun, designed to operate with currents up to 500 amperes, is recommended for welding copper, bronze, stainless steel, nickel, and steel. The use of internal water cooling of the gun and a water-cooled welding cable permit high current capacity without sacrificing lightness and flexibility of the gun.



"Rec" grinding wheel dresser brought out by J & S Tool Co.

Grinding Wheel Dresser with Micrometer Base

A grinding wheel dresser designed to combine the advantages of two previous dressers has been announced by the J & S Tool Co., Inc., 644 W. Mount Pleasant Ave., Livingston, N. J. When removed from its micrometer base, the dresser is ready with the proper fixtures for dressing cylindrical grinding wheels to an accuracy of 0.0001 inch. It can be snapped back into its base for dressing surface grinding wheels to the same accuracy. Also, it can be employed to advantage for under-the-wheel dressing.

Two angular surfaces which are tangent to a radius can be dressed in one continuous motion without the use of dovetail slides. The angles are dressed by continuing to push the handle in either or both directions after the radius is formed. The diamond automatically returns to the center position after dressing the angles. Any beginner can dress complex forms in a short time with no other tools than a micrometer and a hexagonal wrench.

Micro-Grinder with Abrasive Roll for Finishing Sheets

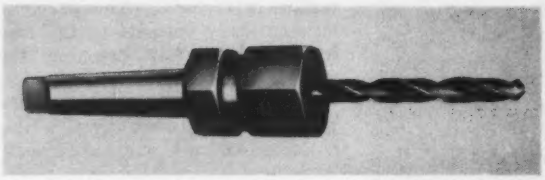
A surface finishing machine has been developed by the Curtin-Herbert Co., Gloversville, N. Y., in cooperation with the Behr-Manning Corporation, Troy, N. Y., to handle sheets of metal, plastic, felt, cork, rubber, or leather in widths ranging from 12 to 80 inches. Standard machine widths, however, range from 40 to 52 inches. This machine is designed to grind wide sheets to the required thickness within a tolerance of plus or minus 0.0005 inch.

Accuracy of the finish-ground sheet depends on the hardness of the material and the amount of stock removed. On relatively soft non-metallic materials, stock to a depth of 0.0625 inch, plus or minus 0.0005 inch, can be removed in one pass through the grinder. Extremely hard non-metallic materials, such as mica and laminated phenolic, have been reduced in thickness by as much as 0.030 inch, plus or minus 0.0005 inch in one pass.

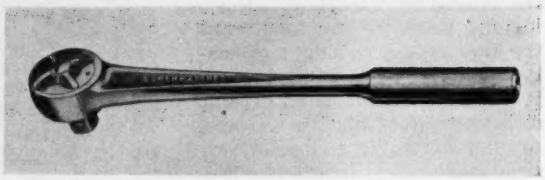
A coated abrasive cover is spirally wound around a drum that is machined to a tolerance of plus or minus 0.0005 inch. The edges of the cover do not overlap but are butted together, permitting utili-

Manual arc-welding gun for "Aircomatic" welding is being marketed by Air Reduction

Curtin-Herbert Micro-Grinder finish-grinds wide sheets of metallic and non-metallic materials



Stub drill chuck introduced by Continental Tool Works



Reversible ratchet manufactured by J. H. Williams & Co.

zation of the entire drum periphery. The cover is secured by a series of clamps that are fastened to movable heads on each drum end which exert outward tension on the cover in the direction of the spiral winding. Either an oscillating or non-oscillating type drum can be used on the grinder. A more uniform finish is, however, generated by the oscillating drum and the life of the coated abrasive is longer than on the non-oscillating drum.

The web stock to be ground is fed into the grinding area by a series of rubber-covered pinch rolls. Mounted directly under the grinding roll is a precision-ground steel "billy" roll that supports the stock as it is being ground. This roll is accurately adjusted vertically by two handwheels positioned on the operator's side of the machine, either of which will actuate the worms and gears that move the roll up to the grinding drum.

Continental Stub Drill Chuck

The Continental Tool Works, Division of Ex-Cell-O Corporation, 1200 Oakman Blvd., Detroit 32, Mich., has announced a new stub drill chuck for use in multiple-spindle heads. This chuck is designed to cut costs of drilling "through" bolt holes or clearance holes. When supported in a rigid, true-running spindle, this chuck projects a minimum distance and thus permits short drills to be used without bushings and bushing plates. More pieces per sharpening of the drill and increased drill life are said to result from this arrangement. A U-shaped drive key which engages notches in the shank of the drill and fits a groove in the faces of the collet and holder provides a positive drive, and prevents the drill from being pushed back into the collet under feeding pressure. Drills are available which have notches in the shank for length adjustment.

Williams Reversible Ratchet

A reversible ratchet, designated No. S-52, is a recent addition to the 1/2-inch square drive "Supersocket" line made by the J. H. Williams & Co., 400 Vulcan St., Buffalo 7, N. Y. This well balanced ratchet has been designed to provide an exceptionally durable concentric type mechanism with unusually small increments of ratchet action. Rotation of nuts in close quarters is made easier and faster by the 82-tooth ratchet. The ratchet shifting mechanism permits instantaneous reversing and one-hand operation.

Wales "Tru-Edge" Contour Shear

Introduction of a Wales "Tru-Edge" contour shear has just been announced by the Wales-Strippit Corporation, 345 Payne Ave., North Tonawanda, N. Y. This shear is designed for inside cutting, beading, and forming sheet steel. A new shearing principle eliminates resistance to feeding and turning the work. In addition, feeding of material may be started while the ram is operating. Inside cutting requires no starting holes.

A unique cam design provides vibrationless operation which shears the material, leaving a smoothly cut edge. An adjustable bottom shearing die can be quickly set to suit material of different thicknesses. The shear will cut from 10 to 36 feet per minute, depending on the thickness and kind of material. The shearing capacity is up to 10 gage mild steel and 11 gage stainless steel. Throat depth is 48 inches, and can be increased by arranging centers outside the throat.

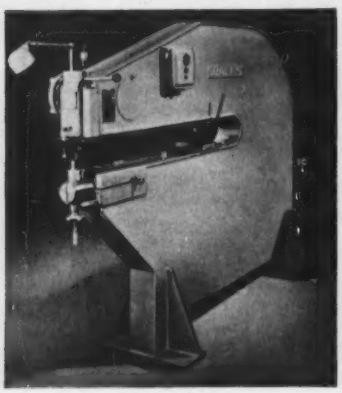


Fig. 1. Front view of Wales "Tru-Edge" contour shear

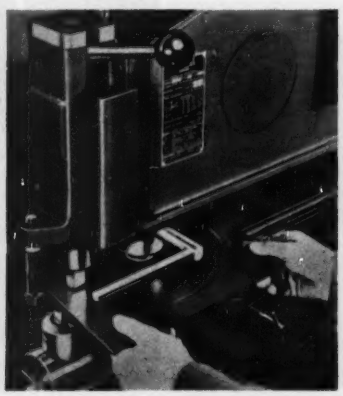


Fig. 2. Cutting circle on machine shown in Fig. 1

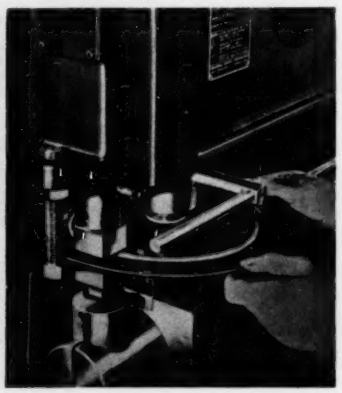


Fig. 3. Circular bead forming on Wales contour shear

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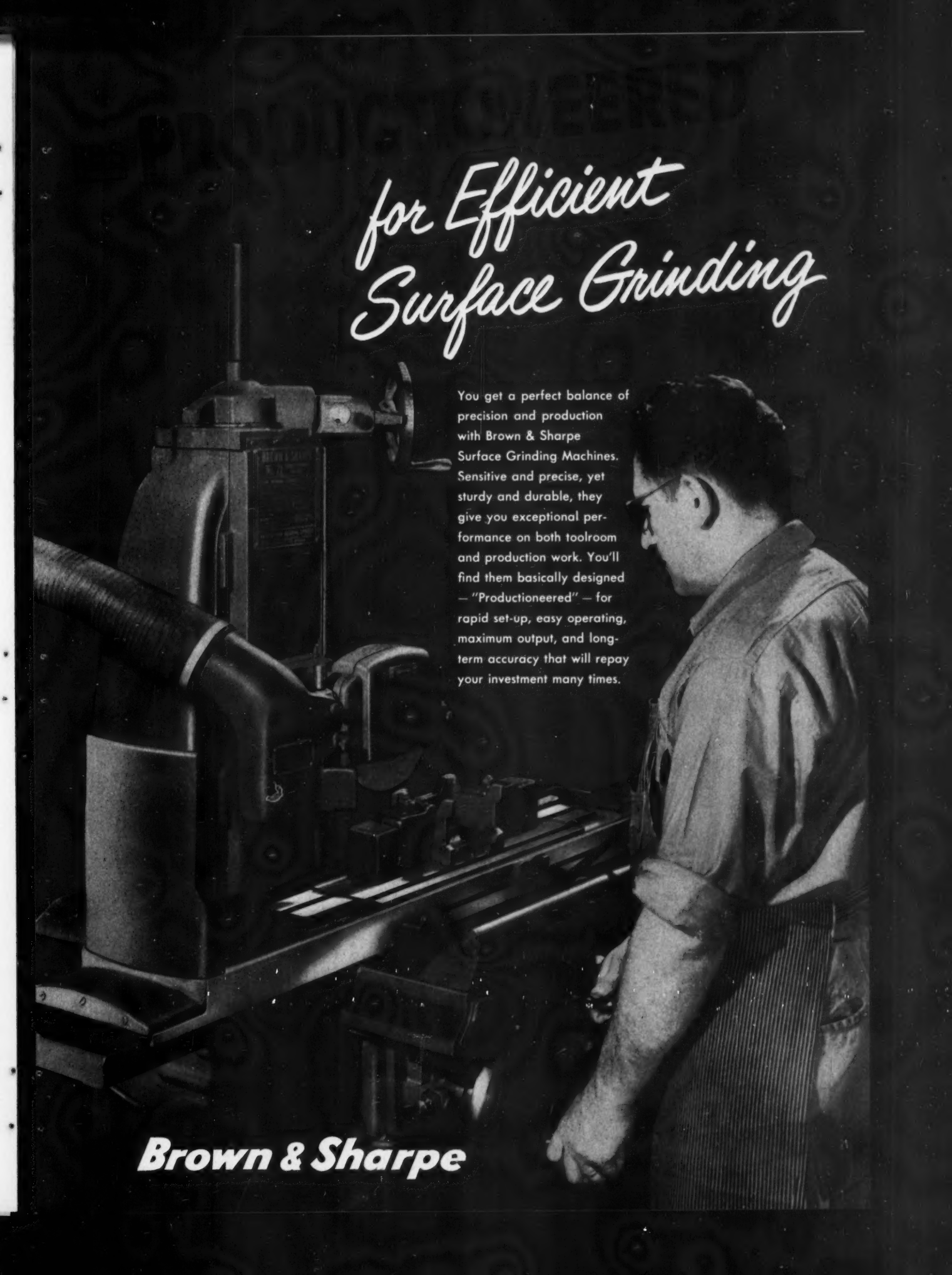
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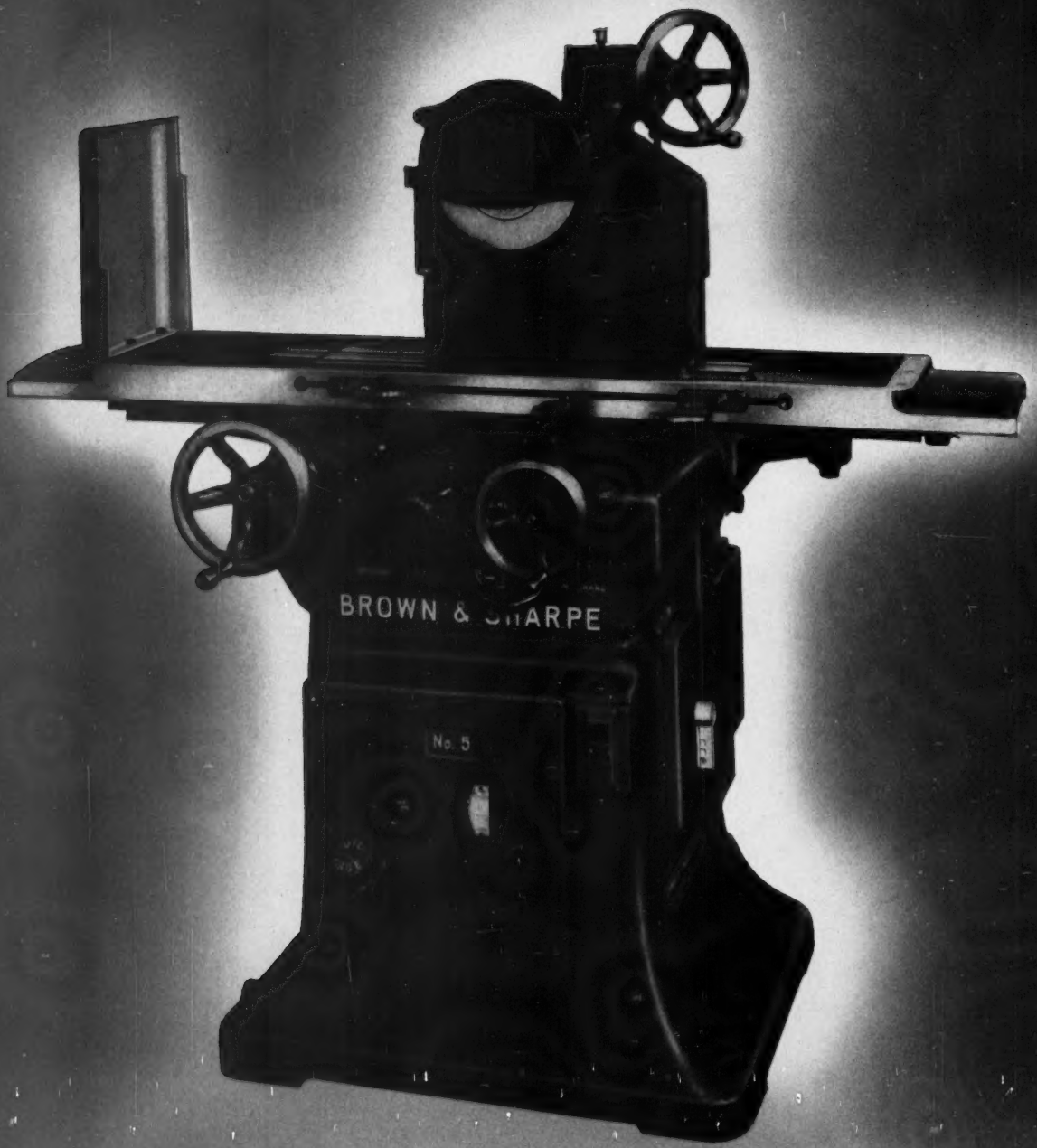
Surface Grinding
You get a perfect balance of precision and production with Brown & Sharpe Surface Grinding Machines. Sensitive and precise, yet sturdy and durable, they give you exceptional performance on both toolroom and production work. You'll find them basically designed — "Productioneered" — for rapid set-up, easy operating, maximum output, and long-term accuracy that will repay your investment many times.
Brown & Sharpe

"Productioneered" to cut



Brown & Sharpe No. 5 SURFACE GRINDING MACHINE

Where precision, fine finish, and rapid stock removal on flat surfaces are equally important, this productive hydraulic-type machine quickly pays for itself. Automatic hydraulic table feeds are powerful, smooth, quiet and infinitely variable. Centrally-located controls permit rapid set-up and easy operation. Flange-mounted removable unit-type wheel spindle provides accuracy of alignment — choice of plain-bearing or antifriction-bearing types. You'll find many other features for speed, safety, accuracy and long life that make the No. 5 ideal on both toolroom and production grinding for work up to 24" long, 8" wide and 11" high.

costs on precision work...

Brown & Sharpe Nos. 2L and 2LB SURFACE GRINDING MACHINES

These machines, long famous for their economical production of small to medium-sized precision work, give you the advantages of automatic lubrication and ample guarding to reduce maintenance costs and extend machine life. Removable unit-type precision wheel spindle, plain-bearing or antifriction-bearing — and rigid column construction—provide exceptional grinding finish with quick spark-out. The No. 2LB Machine with Hand Feeds Only is ideal for toolroom and production work where automatic feeds are not used. No. 2L (illustrated) and No. 2LB grind work to 18" long, 6" wide and 9½" high, using a wheel 7" in diameter.

uniformly accurate

your machines

BROWN & SHARPE
ELECTRONIC MEASURING EQUIPMENT

Precision gaging and inspection as close as .00001" are simple and fast with this equipment that practically eliminates human error — for external or internal measuring.

BROWN & SHARPE
PERMANENT MAGNET CHUCKS

These Permanent Magnet Chucks eliminate clamps, vises, and fixtures on many jobs . . . they're the time-saving way to solve work-holding problems. No operating costs, no electrical connections, no heating. Just turn lever and work is held firmly. Rotary and rectangular models. Wide range of sizes.

For sale only in the United States of America and its Territories.

BROWN & SHARPE
No. 616 CYLINDRICAL GRINDING
AND INDEXING ATTACHMENT

This versatile attachment makes possible dry grinding of small cylindrical work on surface grinders. Accommodates tapers and work requiring indexing. Grinding is done on dead centers. Indexing spring chuck, with spring collets, holds work not ground between centers. Centers swing 6" diameter — take 5¼" length. Table tilts to 45°.

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WRITE FOR COMPLETE INFORMATION ON ANY OF THE BROWN & SHARPE PRODUCTS LISTED AT RIGHT.

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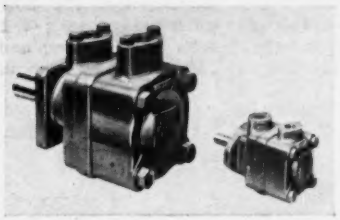


Vane type hydraulic motor being marketed by Vickers, Inc.

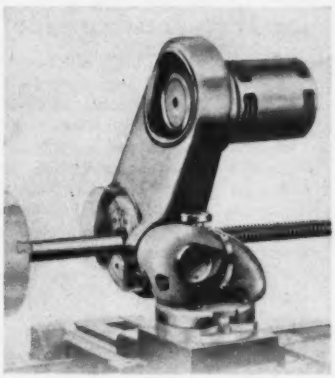
Vickers Vane Type Hydraulic Motors

A line of oil hydraulic vane type motors designed to provide maximum efficiency and economy is announced by Vickers, Inc., 1403 Oakman Blvd., Detroit 32, Mich. These motors are of exceptionally rugged construction. They have heat-treated alloy-steel shafts, rotors, and vanes, and are built to operate under difficult conditions.

A combination of low inertia of moving parts and automatic wear compensation for both radial and axial clearances results in exceptionally high performance efficiency throughout the life of the motor. The motors are unusually compact and light in weight. Mounting adaptability is provided by a choice of four combinations of inlet and outlet port positions, and either flange or foot mounting. Direct, belt, chain, or gear drive is available. Vickers vane type hydraulic motors are now available in 5-, 6.5-, and 26-H.P. output sizes.

"Tu-Flo" Two-Stage Blast Air Blow Gun

An air blow gun with two-stage throttling action, developed to eliminate the danger and discomfort of having a cloud of dust, dirt, or grit blown in the operator's face the instant the air valve is released, has been manufactured by the Supreme Machined Products Co., Spring Lake, Mich. For nine-tenths of the control button travel only a small volume of air is released. If the full blast is desired, the button is pulled all the way. Line pressure sealing serves to make the "triggering" easy and economical.



Thread and worm cutting attachment for lathe manufactured by National Threading Machine Co.

Thread and Worm Cutting Attachment

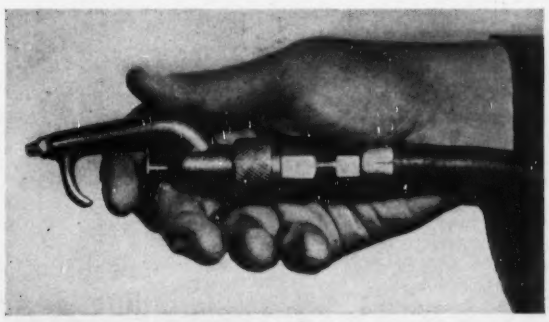
A device designed for use on a standard lathe which is said to make possible the cutting of threads and worms at exceptionally high speeds is being placed on the market by the National Threading Machine Co., 126 Market St., Paterson, N. J. The novel feature of this new equipment is that the actual cutting is done by means of a tool which moves around the work-piece eccentrically at high speed, in a single continuous operation. The equipment cuts long standard vee, Acme, buttress, and rounded threads.

Threads cut with this equipment are claimed to be more exact in pitch than those produced under ordinary machining conditions. Pitch errors produced by torsion strains on the work-piece are eliminated when this new equipment is used. The thread surfaces are said to nearly approach in quality those produced by grinding. Thread flanks, even in soft steel or aluminum parts, show a high polish.

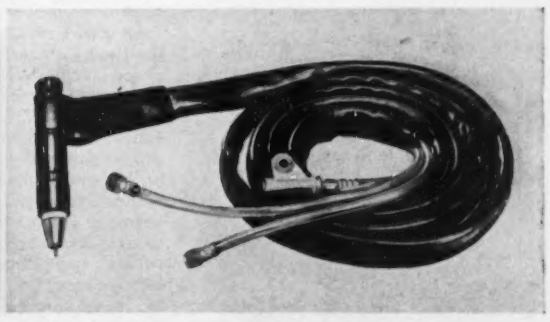
Linde "Heliarc" Torch

A "Heliarc" torch designed for economical heavy-duty machine welding has been developed by The Linde Air Products Company, a Division of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y. This torch is light in weight, and can be mounted on any machine carriage that provides proper speed control for repetitive straight-line, shape, girth seam, or portable welding operations.

Gas leakage and contamination by air are prevented by special gaskets. The design of this torch, known as the HW-13, also minimizes stub loss of expensive tungsten electrodes. Efficient cooling of the torch body, welding head, and gas cup is accomplished by water passages inside the torch body. Water flows unimpeded through these internal passages down to the water jacket and gas cup and out again through the power cable, keeping the torch cool under the most severe welding conditions. Welding nozzles are replaceable without taking the torch apart.



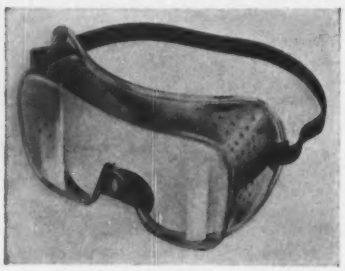
Two-stage blast air blow gun is being marketed by the Supreme Machined Products Co.



Linde torch designed for continuous machine welding at rated capacity of 500 amperes

American Optical Safety Goggles

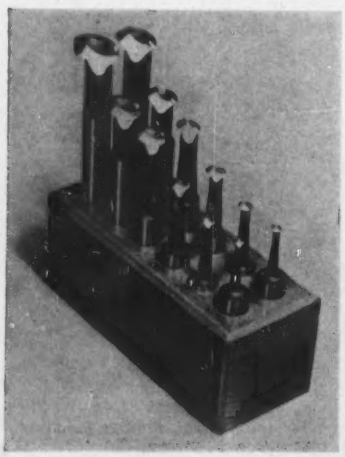
Safety goggle introduced by American Optical Co., Southbridge, Mass., for use in light industrial and laboratory operations. It provides frontal and lateral protection through a clear plastic lens and transparent, green, vented binders which fit snugly to the face. The wearer has a clear view in front, and can readily see to the side although his eyes are shielded against

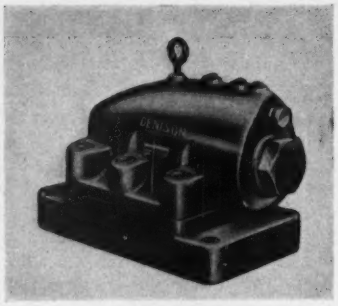


glare by the green coloring of the transparent binders. The goggles give protection against flying foreign particles and spattering chemicals.

Precision Boring and Facing Tools

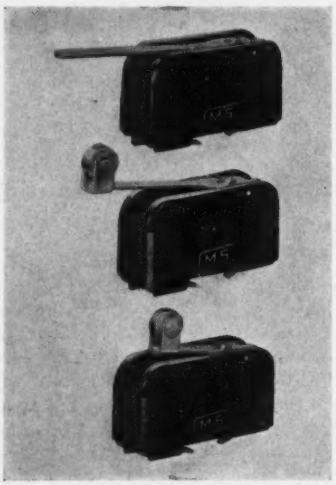
Set of six boring tools and six facing tools made of high-speed steel or carbide recently added to the line of precision metal-cutting tools made by R. B. Tool Co., Inc., 41 E. Hartsdale Ave., Hartsdale, N. Y. The boring tools cover a range of minimum boring diameters from 1/8 to 5/8 inch. Similar sets are available for threading and recessing. Other sets for performing all these four different operations on holes over 2 inches in diameter are available. The precision-ground helical and spiral relief angles of these tools are designed to maintain long life for the cutting edges and simplify sharpening.





Hydraulic Control Valve for High-Pressure Line

New 2-inch "HydrOlLic" relief valve built by the Denison Engineering Co., 1152 Dublin Road, Columbus 16, Ohio, to provide dependable pressure control up to 5000 pounds per square inch with volume capacities up to 125 gallons per minute. This valve features exceptionally low differential between opening and closing pressures, resulting in faster action, closer pressure control, and a reduction of over-pressure and pressure-drop conditions.

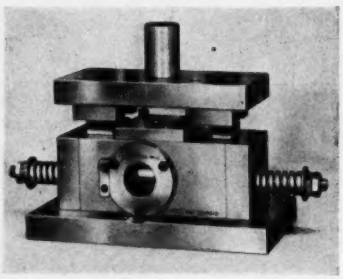


Micro Switches Operated by Low Actuating Force

Snap-action switches, designed for actuation by forces as low as 1/2 ounce, announced by Micro Switch, Division of Minneapolis-Honeywell Regulator Co., Freeport, Ill. These switches are provided with rigid lever integral actuators which adapt them for operation by cams or by straight-line motion. They are particularly useful in low-force, cam-operated applications on timing clock motors, instruments, and meters. The switches are also widely used in rotary switch assemblies, in sequence switching gangs, and in general limit switch applications. All three types are available with solder lug or screw terminals. They are listed by the Underwriters' Laboratories for 15 amperes, 125, 250, or 460 volts alternating current; 1/2 ampere, 125 volts direct current; and 1/4 ampere, 250 volts direct current.

"Arc-Fit" Pipe and Tube Notcher

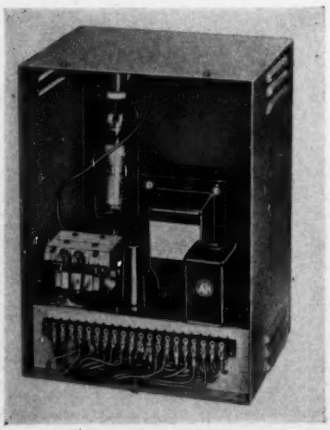
"Arc-Fit" pipe and tube notcher designed to be used with a punch press for notching both sides of a pipe or tube end with a single stroke of the



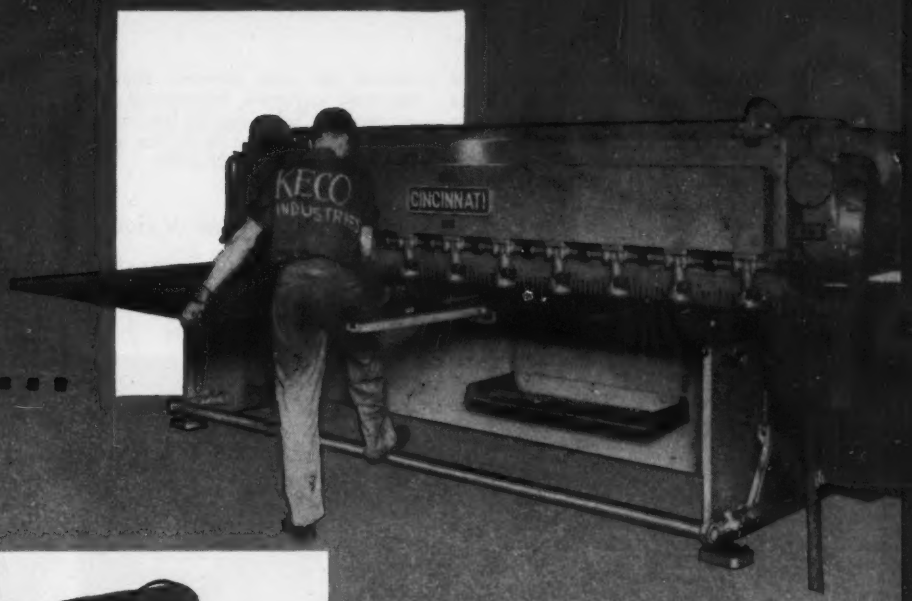
press. When tubing is fed into the die, the punch member of the die enters the tube end. As the press ram comes down, the punch is driven laterally in one direction to notch one side of the tube end, then immediately driven in the opposite direction to notch the other side. Cutting is from the inside out so that clean edges are produced and no further finishing is required. Interchangeable dies, punches, and spacers make this notcher adaptable for notching 1/2-inch to 2-inch pipe and tubing. Product of Vogel Tool & Die Corporation, 1807 N. 32nd Ave., Melrose Park, Ill.

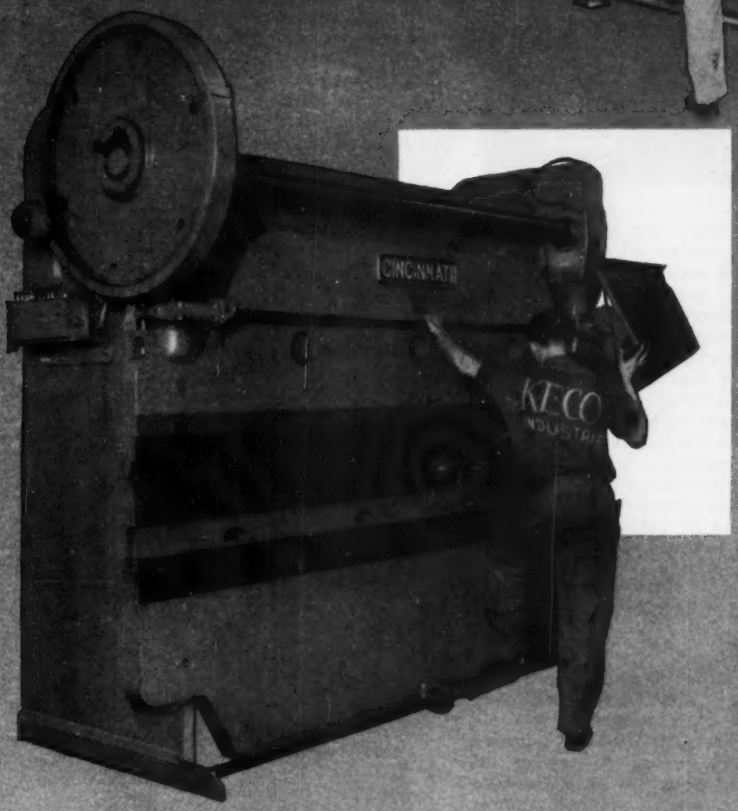
Variable-Speed Drive for Small Motors

Electronic variable-speed drive for fractional-horsepower motors brought out by the Arrow-Hart & Hegeman Electric Co., 103 Hawthorn St., Hartford 6, Conn. This is a low-cost packaged drive



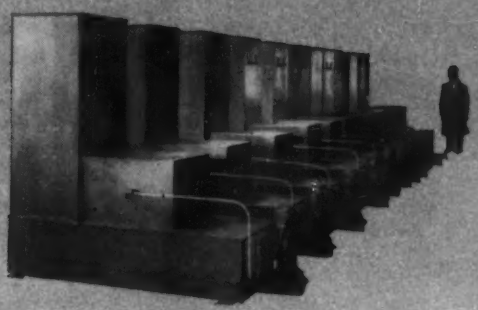
3 times as fast...





with this CINCINNATI team

Photographs courtesy of the Keco Industries, Cincinnati 25, Ohio



Cooling towers for portable air conditioning units

The floor-to-floor time consumed in shearing and forming panels for air-conditioning units, was cut from 12 minutes to 4 minutes at Keco Industries, using a Cincinnati Brake and a Cincinnati Shear.

Accuracy and rapid handling effected these savings.

In your shop, there may be opportunity for real costs reductions. Investigate Cincinnati Shears and Cincinnati Press Brakes.

Write for Cincinnati Shear Catalog S-6 and Cincinnati Brake Catalog B-3.

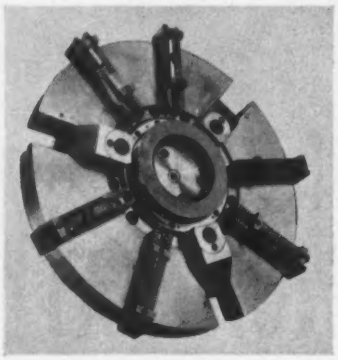
THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

consisting of an electronic, adjustable speed-control unit which drives a series type motor. It provides a wide, stepless range of speed control with good speed regulation under varying loads. With the optional dual range feature, speeds from 100 to 3500 R.P.M. are available. The motor can be started, stopped, or dynamically braked.

Cushman Chucks for Turbine Wheel Machining

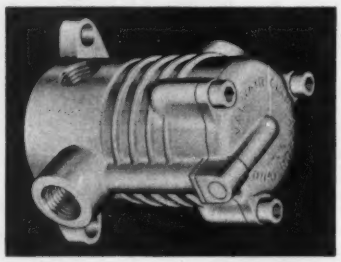
Chuck brought out by the Cushman Chuck Co., Hartford 2, Conn., which has been designed to hold large turbine wheels and jet engine discs and rings in such a manner that they can be



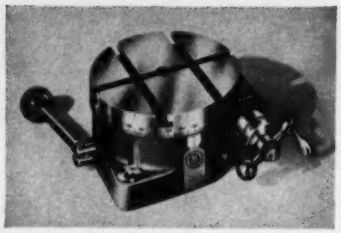
safely machined without fear of distortion or strain. These chucks meet the requirements of rigidly holding large work-pieces of small cross-section without the usual distortion strain or harmonic vibrations encountered when machined at high speeds. They can be furnished on special order for either manual or air power chucking.

Solenoid Pilot Valve

Solenoid pilot valve now being offered by Valvair Corporation, 985 Beardsley Ave., Akron 11, Ohio. This valve is



3 inches high, and is designed to handle air, vacuum, oil, water, and inert gases. The body and cover are made of a high tensile strength zinc-base alloy. The standard coil is adaptable to either continuous or intermittent service, and is completely sealed from, but cooled by, the fluid or air passing through the valve. There are only two moving parts — the plunger and the stem. The valve can be drilled for manifold mounting. It is made in two-way and three-way either normally open or normally closed types, and with orifice sizes of 1/16, 3/32, and 1/8 inch with 1/4-inch pipe threads.

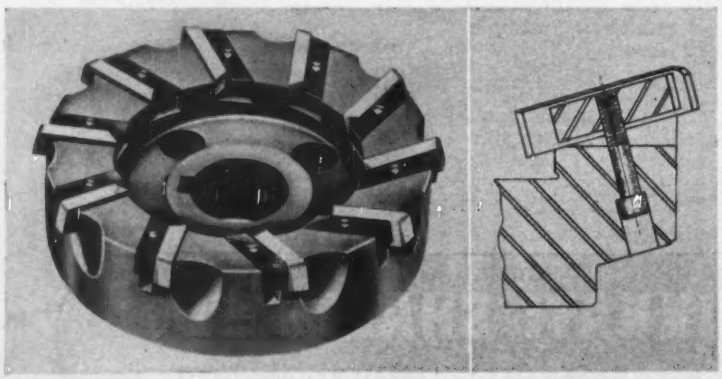


Rotary Table for Small Precision Work

Rotary table designed to hold small work for precision machining operations on a drill press, milling machine, shaper, or surface grinder. Accurate spacing of drilled holes, indexing clutch teeth, milling circular grooves or T-slots, and machining square and hexagonal shapes are some of the operations that can be performed on this versatile rotary table just placed in production by the South Bend Lathe Works, South Bend 22, Ind. The precision-ground work-table is 4 1/2 inches in diameter, and has three T-slots for clamping the work. The table is rotated by worm-gearing having a worm-shaft with a graduated collar and ball-crank. Each graduation indicates an angular table movement of 3 minutes, and one complete revolution of the ball-crank turns the table through an angle of 5 degrees. A small knurled thumb-screw permits easy resetting of the graduated collar to zero.

Improved Face-Milling Cutter with Interchangeable Carbide Blades

Improved solid carbide inserted blade face-milling cutter, designated the "IBH" type, which can also be used as a half-side mill. This cutter, recently announced by the Super Tool Co., 21650 Hoover Road, Detroit 13, Mich., has only three parts, the blade, wedge, and screw, which are assembled with the steel body. The body is recessed below each wedge to facilitate quick and easy wedge removal. The threads are in the wedges and not in the body. This and other design features are shown in the section view to the right in the accompanying illustration. All blades and parts are interchangeable and can be reversed and used in either right- or left-hand bodies. This cutter is available in six standard sizes ranging from 4 to 14 inches in diameter.



Screw Extractors

Screw extractors recently added to the line of tools manufactured by J. H. Williams & Co., 400 Vulcan St., Buffalo 7, N. Y. The removal of broken screws, bolts, studs, or other threaded forms without injury to the tapped threads can be quickly and easily accomplished by using these extractors. The extractors are especially useful in industrial plants, machine shops, garages, shipyards, and railway shops. They are available in nine sizes, individually packaged in cardboard envelopes, and in sets complete with stand.

drill with the right machine...

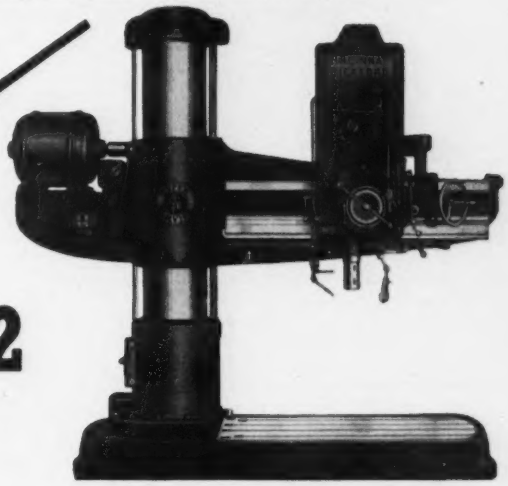
Wise selection from the line of Super Service Drilling Machines will bring low cost production to your shop.

As your drilling problems are our problems, our engineers are ready to cooperate with you. We believe their services will be of real value.

Write for literature on machines of interest to you.

1

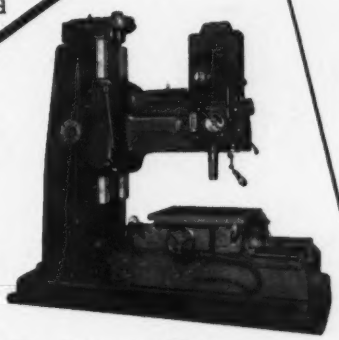
The 9" Diameter Column SUPER SERVICE Radial Drill, described in Circular R-21B, is built in either a 3' or 4' arm length with 9 speeds and 4 feeds powered with a 3 HP driving motor.



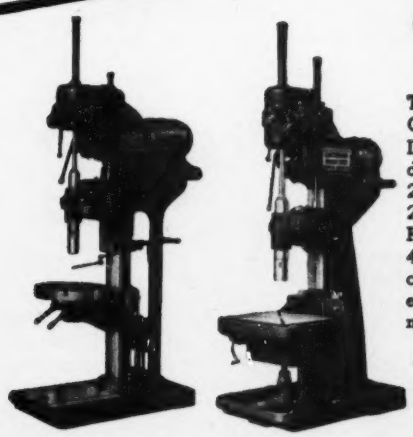
2

The 36-speed 18-feed SUPER SERVICE Radial Drill, described in Booklet R-29, is furnished in 11 different standard sizes, ranging from 3' to 8' arm lengths and 11" to 19" diameter columns. Machines are furnished with 7½ to 20 HP driving motors.

3



The new SUPER SERVICE Precision Drilling Machine is especially suited to operations in conjunction with an automatic spacing table. This 36-speed, 18-feed, 10 HP motor machine is more completely described in Circular FH.



4

The SUPER SERVICE General Purpose Upright Drilling Machines, as described in Booklet U-25-A, are furnished in 21", 24" and 28" sizes. From 9 to 12 speeds and 4 to 9 feeds. The machines are powered by either 3, 5, or 7½ HP motors.

5

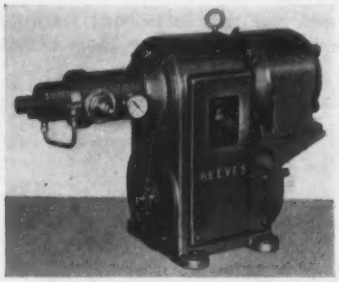
The SUPER SERVICE High Production Manufacturing Uprights have many of the advantages of the general purpose drilling machines but, due to their simplified construction, they are much more economical. They are furnished in 21", 24" and 28" sizes with 3, 5, 7½ or 10 HP driving motors. Booklet U-27 will furnish you more complete details.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

Motodrive with Conoflow Control

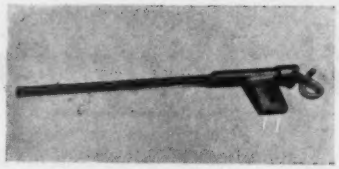
"Vari-Speed Motodrive" with new "Conoflow" control recently added to the line of equipment manufactured by the Reeves Pulley Co., Columbus, Ind.



The new control is available with 6 to 1 maximum speed ranges on all units with capacities to 25 H.P. The present hydraulic and pneumatic controls still are available as well as the Conoflow cylinder. The application of this new control makes it possible to use the Motodrive for automatically controlling flow proportioning systems of liquid, gas, and chemicals, as well as pressure and temperature.

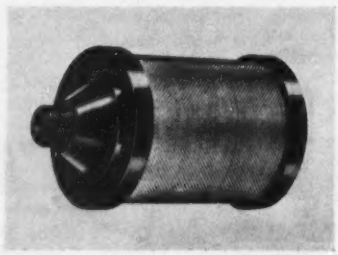
Portable Electric Heater for Preheating Large Studs to Obtain Tighter Fits

Heavy-duty electric heater designed to preheat large studs that are used to clamp castings together on heavy equipment, such as hydraulic presses. Quick heat is provided at the assembly point with this portable electric heating unit made by Edwin L. Wiegand Co., 7678 Thomas Blvd., Pittsburgh 8, Pa. To tighten nuts, the studs are lengthened temporarily by drilling a hole through the stud and inserting the stud heater in this hole. The stud, thus expanded lengthwise, allows the nut to be tightened more than would be possible if the stud were cold. When the heater is withdrawn and the stud cools, a very tight fit results.



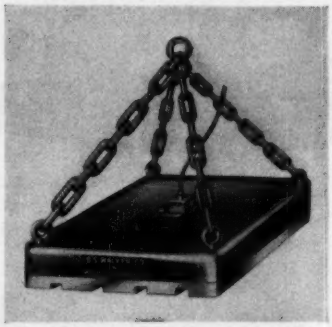
Muffler for Silencing Noise of Air Exhausts

Radial-flow muffler designed to provide positive noise control of air-operated equipment. This muffler has been developed by the Allied Witan Co., 4315 W. 138th St., Cleveland, Ohio, to reduce noise, thus saving wear and tear on operators' nerves; prevent injury from exhaust air; and eliminate the hazard of flying pipe scale. The muffler can be successfully used to eliminate exhaust noise on air cylinders, air motors, vacuum pumps, air vises, power presses, drill presses, and most other air-operated equipment.



Lifting Magnet

Lifting magnet available in 24-, 30-, 36-, and 48-inch square sizes, from the O. S. Walker Co., Inc., Worcester 6, Mass. Advantages claimed for this magnet are exceptionally light weight and a shape that enables it to get into square corners. The magnet operates on direct current.

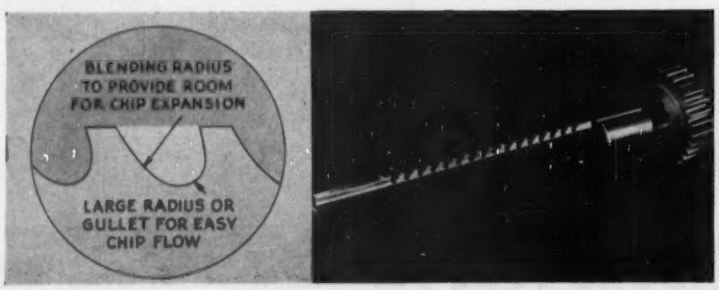


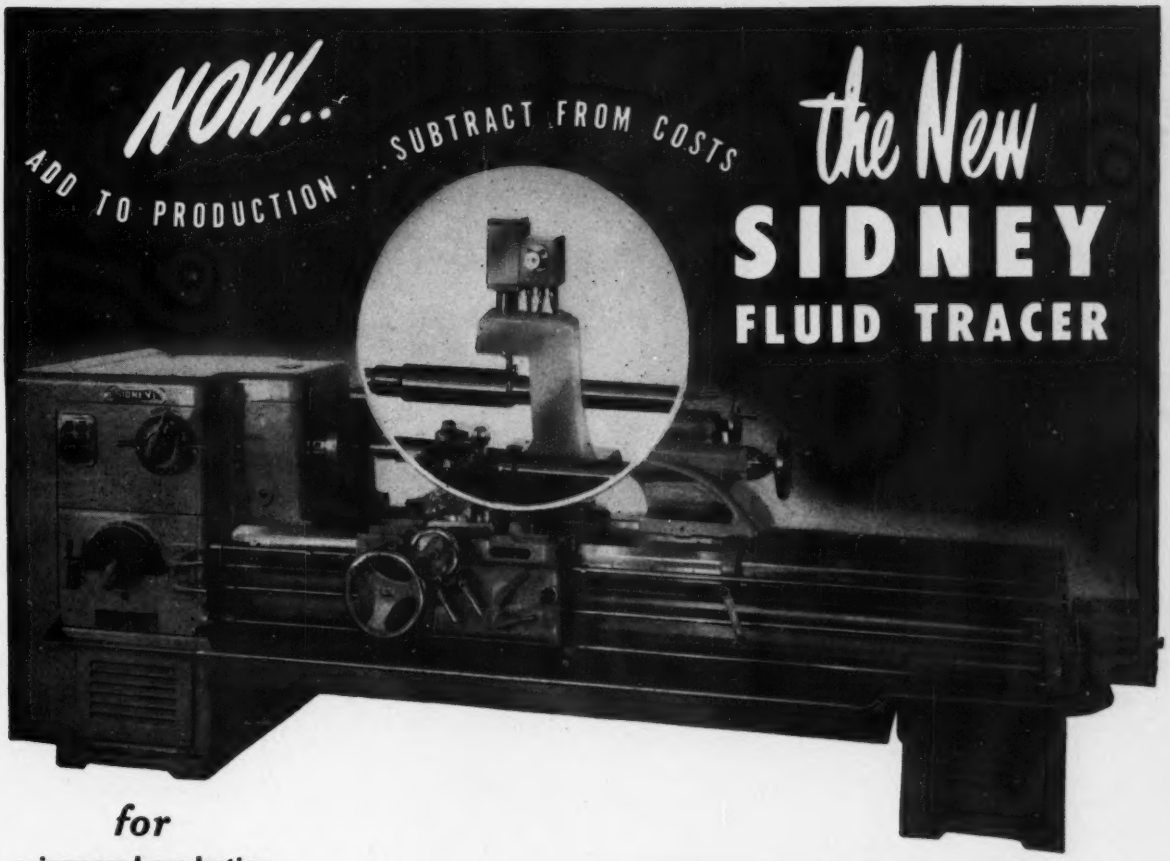
Projector for Checking Squareness and Parallelism

Projection angle "Dekkor" auto-collimating unit which shows by direct readings on a convenient projection screen the squareness of a reflecting surface placed in the path of its light. Thus, it is possible to inspect simultaneously a number of surfaces and determine thereby their parallelism to each other. Reflectors are available for otherwise difficult inspection jobs, such as determining squareness of holes to reference surfaces, parallelism of two or more bores, parallelism of two or more planes, etc., Product of Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill.

"Minute Man" Keyway Broach with New Tooth Form

The du Mont Corporation, Greenfield, Mass., has developed a new tooth form, shown diagrammatically in the view at the left, which is now being incorporated in all of its "Minute Man" keyway broaches. The form is said to give more chip room, assure better curling of the chips, and prevent clogging or wadding. Preceding forms had a straight flank and small radius which tended to corrugate the chip and result in a poor finish. The new tooth form is available in all broach sizes from 1/16 to 1 inch.





for

- **increased production**
- **greater versatility**
- **wider range of work**
- **LOWER COSTS**

Here's an all-hydraulic controlled tracer with a DUAL PURPOSE . . . for tracing from round or flat template and regular lathe work with unlimited range for both.

Note how simple: just position one lever on clutch and brake unit to engage or disengage the tracer . . . that's all. No loss of time, no extra space, no parts to bother with, no extra expense for a single-purpose tool.

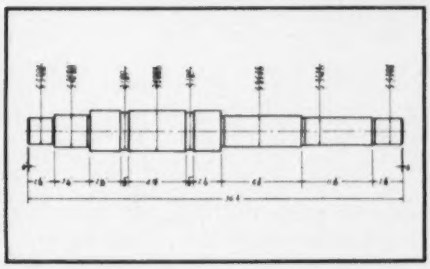
ABSOLUTELY SAME PRECISION ACCURACY AS WITH ALL SIDNEY PRODUCTS. Contour changes of the master piece are transmitted through the ultra-sensitive tracer valve as magically as if by an "electric eye" . . . even sharp shoulders are faced to amazingly close limits.

ADD the Sidney Fluid Tracer to any Sidney Model 32 Lathe. You'll enjoy the savings and efficiency of

THE FINEST TURNING TOOL EVER PRODUCED

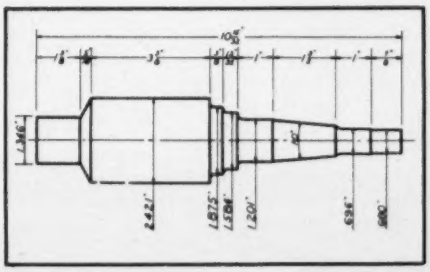
Please write for detailed literature or contact your nearest Sidney representative.

AMAZING SAVINGS THROUGH SIDNEY TURNING TIME



Normal Turning Time
4 hrs. 33 min.
SIDNEY TURNING TIME
38 min.
YOU SAVE
3 hrs. 55 min.

•



Normal Turning Time
25 min.
SIDNEY TURNING TIME
2 min. 31 sec.
YOU SAVE
22 min. 29 sec.

The SIDNEY MACHINE TOOL Company
Builders of Precision Machinery
SIDNEY — ESTABLISHED 1904 — OHIO

Case of the Nine Drifting Slots

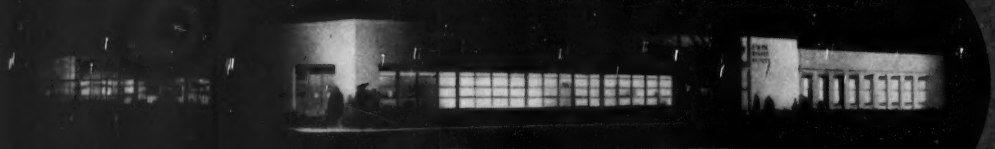
At Detroit Broach a baffling case came up recently—but it was solved in an ingenious manner.

A manufacturer found he was having considerable trouble holding close spacing tolerances on nine precision slots in the O.D. of a ring. When one slot at a time was made, the slot closed in afterward, leaving the slot undersized. This close-in made it difficult to hold spacing tolerances between the nine slots.

Detroit Broach was called in on the case, and after study, recommended that all nine slots of the nut be broached at one time. This was done on a vertical pull-down broaching machine. In contrast to common practice the work travels and the broaches are stationary in a special holder. In this manner the work is pulled through the broach holder and all nine slots are produced in one pass. Guides are incorporated in the set-up to prevent the work from drifting during the cutting operation.

This is just typical of the solutions made every day at Detroit Broach. If you have a special broaching problem, or if you would like further information on the cost saving advantages of broaching, it will pay you to contact Detroit Broach.

WORLD'S LARGEST MANUFACTURER OF BROACHES AND BROACHING TOOLS EXCLUSIVELY



DETROIT BROACH COMPANY

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PRODUCT INFORMATION SERVICE

Use the postage-free postcard below for further information on New Catalogues described in the January, 1953, issue of MACHINERY. Circle key number of item in which you are interested and print name and address on postcard.

NEW CATALOGUES

REFERENCE TABLES FOR TOOL STEEL USERS —A. Milne & Co., 745 Washington St., New York 14, N. Y. Booklet containing a temperature conversion table, a hardness conversion table, shop formulas for obtaining weights of steel bars, and a table for determining weights of steel bars. Can be obtained upon company letter-head request to address above.

UNIVERSAL JOINTS — Apex Machine & Tool Co., 1031 S. Patterson Blvd., Dayton 2, Ohio. Catalogue 27, descriptive of Apex heavy-duty universal joints for aircraft and industrial applications. Can be obtained by writing on company letter-head direct to the address above.

METAL SPINNING TOOLS—Boice Crane Co., 959 Central Ave., Toledo 6, Ohio. Booklet entitled "Metal Spinning Tools and Their Use." Can be obtained by letter-head request direct to the company.

TUNGSTEN-CARBIDE PRODUCTS—Metal Carbides Corporation, Youngstown, Ohio. Catalogue 52G, containing 72 pages of descriptive information on the company's full line of tungsten-carbide products, including cutting tools, drawing dies, bushings, gages, centerless blades, diamond wheels and wheel dressers, and solid carbide stock. Engineering data is included on speeds and feeds, brazing and grinding instructions, grinding wheel recommendations, and coolants. 1

MACHINE TOOLS AND PARTS — Ex-Cell-O Corporation, Detroit, Mich. Catalogue 27312, showing the diversified products manufactured by the corporation, such as precision boring machines, jet-blade finishing machines, thread and tool grinders, cutting tools, etc. A concise description of each product is presented. 2

TRANSFER MACHINES — Motch & Merryweather Machinery Co., Cleveland, Ohio. Folder descriptive of the M & M in-line automatic transfer machine, in which an unusual number and variety of machining operations are combined in one unit. Such operations include milling, turning, centering, chamfering, boring, etc. 3

MACHINES FOR THE SHEET-METAL SHOP — Niagara Machine & Tool Works, Buffalo, N. Y. Booklet 200-H, illustrating and describing the company's machines and tools for light-gage sheet-metal work, such as folders and brakes, rotary machines, slip roll formers, groovers, shears, and hand and bench tools.....4

FABRICATING METALS—General Plate Division, Metals & Controls Corporation, Attleboro, Mass. Catalogue PR-700, outlining the facilities of the Division for the production and fabrication of solid precious and precious-clad base metals, composite base metals, electrical contacts, and contact assemblies.....5

STAMPING PRESSES — Verson Allsteel Press Co., Chicago, Ill. Catalogue giving condensed specifications for the entire line of stamping presses made by the company. Included are standard mechanical and hydraulic presses and press brakes, as well as data on special-purpose presses. 6

CUTTERS FOR NON-FERROUS METALS—Onsrud Cutter Mfg. Co., Libertyville, Ill. Catalogue 52-A, covering the company's complete line of routing and milling cutters for the non-ferrous metal-working industries. Included are cutters of special design required by the aircraft industry. 7

STEEL SELECTION—Joseph T. Ryerson & Son, Inc., Chicago, Ill. Bulletin consisting of a guide to steel selection for reference to mechanical properties, characteristics, and uses of carbon and alloy steels available from Ryerson stock. 8

A BIBLIOGRAPHY OF GEAR PRODUCTION METHODS—National Broach & Machine Co., Detroit, Mich. Leaflet consisting of a bibliography of gear production methods compiled by the company for the convenience of those responsible for gear production. 9

LAPPING—Michigan Tool Co., Detroit, Mich. Bulletin 993-5, describing external lappers for lapping external gears from ½ inch to 20 inches in diameter. Close-up views show lapping operations on herringbone and helical gears. 10

TAPS—DoAll Co., Des Plaines, Ill. Bulletin 51-813, listing the company's line of hand, machine screw, nut, pulley, pipe, tapper, and hook taps. Included are charts giving drill sizes for various thread dimensions. 11

TOTALLY-ENCLOSED MOTORS—U. S. Electrical Motors, Inc., Los Angeles, Calif. Bulletin 1784, descriptive of totally-enclosed motors for protection against dust, moisture, abrasives, and drippings. 12

TWIST DRILLS—DoAll Co., Des Plaines, Ill. Bulletin 51-816, containing pertinent information on various types of twist drills. A table giving decimal equivalents of drill sizes is included. 13

PROTECTIVE COATINGS — Ric-Wil Plastic Coating & Mfg. Corporation, Cleveland, Ohio. Folder S-5251, featuring Ricwilite 7100 — a corrosion-resistant, phenolic resin cold-setting coating. Folder S-5252, on Ricwilite 1060—a "baked-on" coating. 14

INDUSTRIAL FILTERS — Industrial Filtration Co., Lebanon, Ind. Folder descriptive of Delpark endless belt type and disposable belt type industrial filters. Included is information on the sizes, capacities, performance characteristics, and applications of these filters. .. 15

INVESTMENT CASTING ALLOYS — Cannon-Muskegon Corporation, Muskegon, Mich. Folder presenting a description of the company's service to the investment casting industry in producing MasterMet certified alloys to specifications. 16

RETAINING RINGS—Waldes Kohinoor, Inc., Long Island City, N. Y. 52-page comprehensive catalogue containing engineering specifications, data, and useful information on seventeen different types of Truarc retaining rings. 17

ELECTRONIC INSTRUMENT—Anco Instrument Div., American Name Plate & Mfg. Co., Chicago, Ill. Folder describing the Elec-Detec—a portable electronic instrument for locating friction noises in bearings, pistons, gears, etc. 18

FORGING PRESSES—Clearing Machine Corporation, Chicago, Ill. Bulletin 217, explaining the features of the Clearing forging press used both for hot forging and for cold coining. Specifications are given. 19

METAL CLEANING — E. F. Houghton & Co., Philadelphia, Pa. Leaflet descriptive of Houghto-Clean 439 and 440, cold cleaners developed for the cleaning of metal parts in power washers at room temperature. 20

AIR CYLINDERS—Tomkins-Johnson Co., Jackson, Mich. Bulletin SM-11-1-52, explaining the features of the new Spacemaker air cylinders, which include a saving in mounting space. 21

PRESS-ROOM EQUIPMENT—Durant Tool Supply Co., Providence, R. I. Catalogue descriptive of Durant Selecto-Matic indexers, scrap choppers, stock straighteners, and other press-room equipment. 22

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OPTICAL INSTRUMENTS — Bausch & Lomb Optical Co., Rochester, N. Y. Catalogue D-22, describing functions and general applications of seven types of optical instruments for quality control. 23

ALUMINUM SOLDERING AND BRAZING — All-State Welding Alloys Co., Inc., White Plains, N. Y. Folder containing explicit information on how to solder, braze, and weld aluminum and aluminum alloys. 24

THREAD GRINDERS—Ex-Cell-O Corporation, Detroit, Mich. Bulletin 48824, featuring the Style 36 precision thread grinder for tool-room and production grinding. 25

CONVEYORS — May-Fran Engineering, Inc., Cleveland, Ohio. Bulletin MF-640, descriptive of the Chip-Tote conveyor, which permits scrap removal without shut-down time loss. 26

MOTOR CONTROLS—Arrow-Hart & Hegeman Electric Co., Hartford, Conn. Folder explaining the "right angle" design of Type RA motor controls. 27

INDUSTRIAL FREEZERS AND TESTING UNITS —Industrial Freezer Division, Webber Appliance Co., Inc., Indianapolis, Ind. Informative folder on low-temperature industrial freezers and complete temperature range testing units. 28

ACCESSORIES FOR TESTING MACHINES — Tinius Olsen Testing Machine Co., Willow Grove, Pa. Catalogue 46, giving detailed information on instrumentation, tools, and accessories for Olsen universal testing machines. 29

AIR-GAS MIXING — Eclipse Fuel Engineering Co., Rockford, Ill. Bulletin L-700, featuring the "Vari-Set" proportional mixer with adjustable jet for use with all commercial gases...30

SPEED REDUCERS — D. O. James Gear Mfg. Co., Chicago, Ill. Catalogue 45-C presenting specifications, rating tables, and dimensions of Type "S" worm gear speed reducers. 31

CARBONITRIDING FURNACES — Lindberg Engineering Co., Chicago, Ill. Bulletin 241, describing gas-fired, vertical radiant tube carbonitriding furnaces for hardening, carburizing, and annealing applications. 32

CONTROLLERS — Bristol Co., Waterbury 20, Conn. Bulletin C305, on the line of time-cycle controllers made by the company, and describing their application in timing industrial process operation. 33

STEEL STOCK LIST AND CALCULATOR—Chicago Steel Service Co., Chicago, Ill. Stock list for stainless steel buyers; and a price calculator which converts pricing code numbers on all stainless steel items listed into current prices. 34

MEASURING SURFACE ROUGHNESS — Micrometrical Mfg. Co., Ann Arbor, Mich. Catalogue containing a description of Profilometer equipment. Each item is shown in use. 35

FLEXIBLE TUBING—Flexible Tubing Corporation, Guilford, Conn. Catalogue C2-4, giving information on Spiratube A for ventilation, fume, and dust removal; and Spiratube R for materials-handling. 36

SCREW CALCULATOR—Standard Pressed Steel Co., Jenkintown, Pa. Screw calculator designed to help engineers, specifiers, and others to quickly select the correct sizes of socket screws. 37

AUTOMATIC LATHE — Gisholt Machine Co., Madison, Wis. Form 1159, describing the design features of the Simplimatic automatic lathe, and showing thirty-one tooled applications. 38

BENCH TYPE MILLERS — Barker Engineering Co., Cleveland, Ohio. Leaflet showing operations performed by the bench type millers manufactured by the company. 39

BENDING ROLLS — Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 88-A, featuring the 6-inch series bending machines for rolling cylinders. 40

SHAPERS — Smith & Mills Co., Chicago, Ill. Catalogue 100, presenting concise information on both the standard and heavy-duty shapers manufactured by the company. 41

CHECKING MACHINES—Michigan Tool Co., Detroit, Mich. Bulletin 876-464, describing the Model 876 "Sine-Line" hob and worm lead checker and the Model 464 hob contour checker. 42

CARBIDE ALLOYS — Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Catalogue giving information on new production techniques and applications of Carmet sintered carbides.....43

BUTTON HEAD SOCKET SCREWS — Standard Pressed Steel Co., Jenkintown, Pa. Bulletin on the company's new line of Unbrako button head socket screws. Some applications are illustrated. 44

RESTRICTOR VALVES — Fluid Controls, Inc., Mentor, Ohio. Catalogue Sheets 3.21, 3.22, and 3.23, descriptive of restrictor valves used to regulate the speed of a cylinder in one direction. 45

GAGE-BLOCKS—Webber Gage Co., Cleveland, Ohio. Booklet giving data on Webber steel and carbide gage-blocks. Information on the care of blocks is included. 46

CONCENTRIC GRINDERS — Landis Tool Co., Waynesboro, Pa. Bulletin CX-52, describing and illustrating the new Landis 4-inch concentric grinding machine. 47

METAL-CLEANING EQUIPMENT — Topper Equipment Co., Clark Township (Rahway), N. J. Bulletin 521, descriptive of Circo degreasers for metal cleaning. 48

PAINTS AND PRIMERS—U. S. Stoneware Co., Akron 9, Ohio. Bulletin 730, telling where and how to use Tygon plastic paint and Tygorust vinyl primer. 49

PRODUCTION FACILITIES—Seren Tool & Mfg. Co., Chicago, Ill. Pamphlet showing the company's precision machining facilities for customers' products. 50

SELENIUM RECTIFIER WELDERS—Miller Electric Mfg. Co., Appleton, Wis. Folder giving details on Miller selenium rectifier direct-current welders. 51

X-RAY ACCESSORIES—Bar-Ray Products, Inc., Brooklyn, N. Y. Catalogue W-52, containing 72 descriptive pages on X-ray accessories and radiation protection. 52

FIXED GAGES — Threadwell Tap & Die Co., Greenfield, Mass. 48-page catalogue, describing and illustrating the company's line of fixed gages. 53

TOOL BITS — Whitman & Barnes, Plymouth, Mich. Catalogue listing Hercules carbide and high-speed tool bits, giving specifications and prices. 54

GRAVITY FEED OILERS—Oil-Rite Corporation, Manitowoc, Wis. Leaflet 61-11, containing specifications of large-capacity gravity feed oilers. 55

STEEL TUBING — Pacific Tube Co., Los Angeles, Calif. Bulletin 10, giving technical data on Patco steel tubing and cold-finished rods and bars. 56

RECORDING EQUIPMENT—Sanborn Co., Cambridge, Mass. Booklet telling advantages of Sanborn direct-writing recorder for industrial users. 57

CUTTING TORCH — Arcair Co., Bremerton, Wash. Leaflet illustrating typical applications of the Arcair torch in gouging and cutting metals. 58

MAGNETIC HOLDERS — Cullen Mfg. Co., Racine, Wis. Bulletin 752, describing the Erick Magna-Holder for indicators, lights, and shields. 59

DRILL STOPS—Scully-Jones & Co., Chicago, Ill. Bulletin 18-50, describing Scully-Jones drill stops—a positive control for depth of hole. 60

CUTTING TORCH—K-G Equipment Co., Long Island City, N. Y. Catalogue Sheet M38, showing the company's line of cutting torches. 61

ELECTRODES—Alloy Rods Co., York, Pa. Bulletin AR52-2218, on "Nickel-Arc 60" electrodes for machinable welds on cast iron. 62

HACKSAWS—Sales Service Machine Tool Co., St. Paul, Minn. Bulletin 1052, featuring ten models of Keller power hacksaws. 63

ELECTROFORMING—International Nickel Co., Inc., New York City. Reprint entitled "Electroforming Difficult Shapers." 64

FASTENERS — Prestole Corporation, Toledo, Ohio. Catalogue Sheet 8000-A-5M, containing engineering and application data on Prestole snap nut fasteners. 65

Product Information Service

Use the postage-free postcard below for requesting further information on New Catalogues. Simply circle the numbers of the items in which you are interested. Please print your name and address.

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

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SNAP and STAMINA!

NEVER BEFORE in this type of valve—ruggedness, reliability, low cost and low maintenance, PLUS the choice of foot or hand lever control. That's Ross' answer for small air cylinder use on machines where easy operation, continuous high production and compactness are "musts". It's Ross quality, of course, precision-machined brass and stainless steel construction, yet at a price you can't afford to pass up.

Available
¼" 3-way
¼" 4-way
Your choice foot or hand lever.

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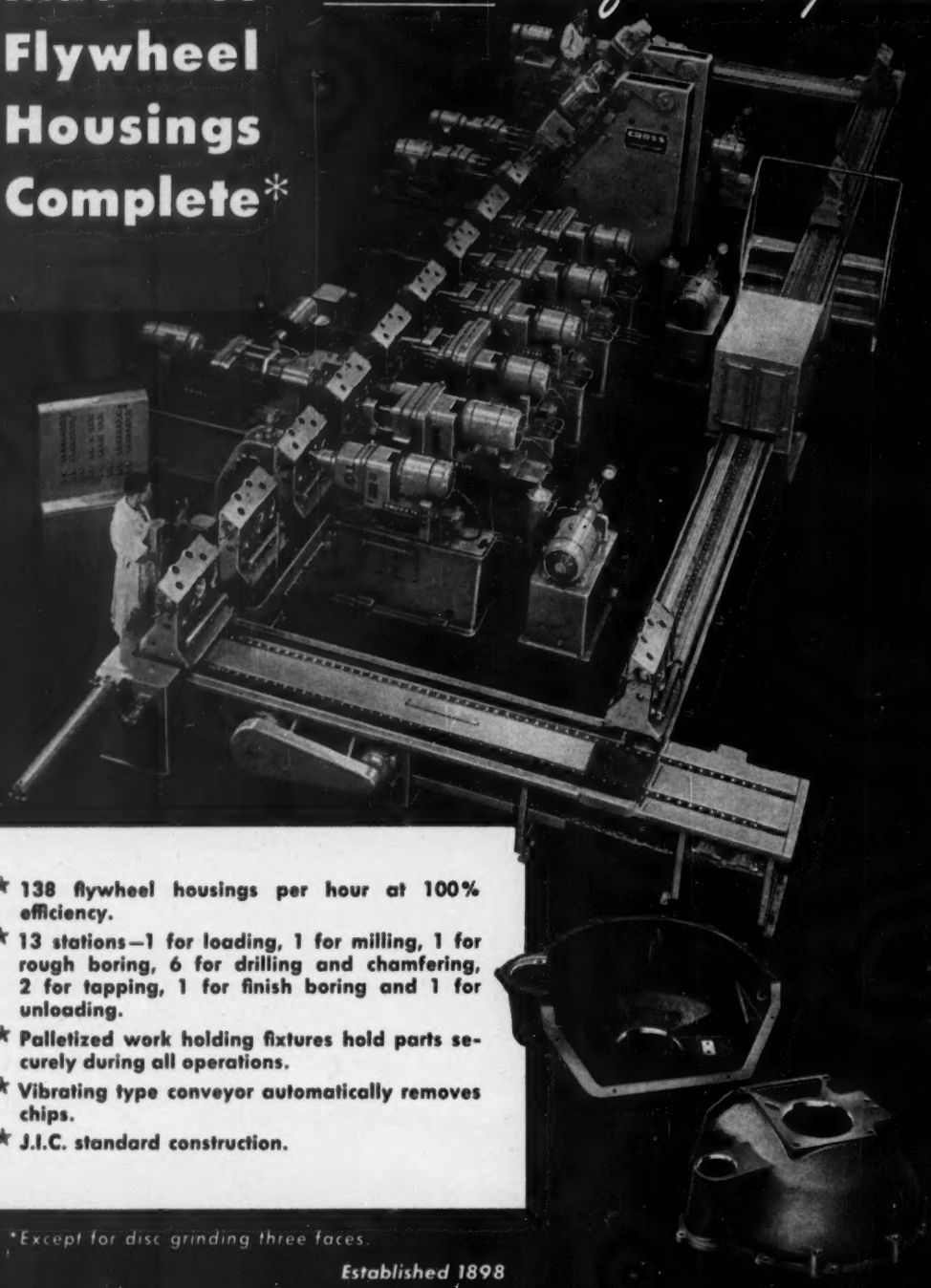
Machines Flywheel Housings Complete*

Another Transfer-matic by Cross



★ 138 flywheel housings per hour at 100% efficiency.

★ 13 stations—1 for loading, 1 for milling, 1 for rough boring, 6 for drilling and chamfering, 2 for tapping, 1 for finish boring and 1 for unloading.

★ Palletized work holding fixtures hold parts securely during all operations.

★ Vibrating type conveyor automatically removes chips.

★ J.I.C. standard construction.

*Except for disc grinding three faces.

Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

Between Grinds

By E. S. Salichs

Is Our Face Red — and For Christmas Too!

At least when MACHINERY pulls a boner it is done at a time of year when the spirit of bonhommie, we trust, will prevail. We are referring to a mechanical error in binding which resulted in a reversal of the two-page advertisement of The Bullard Company in our December number. To add to our misery, Bullard had gone all out on the first page of the advertisement wishing "To the world in general and to you in particular... Merry Christmas and a Happy New Year," then following up with a reference to Bullard equipment listed on the next page. By the process of inversion, as you may readily see, our readers were thereby directed to another company's advertisement instead of to the description of Bullard machine tools which had thus preceded the Christmas greeting. Apologies to Benign Bullard!

We'll Ransom Your Brain Child

If you know a better or novel way of designing a tool or machine, if you have adapted standard equipment for some unusual application, or if you have a new wrinkle to some mechanical principle (no perpetual motion machines or Rube Goldbergs, please), send us a draft and sketch of same. Our staff will put it in shape for our Tool Engineering Ideas and Ingenious Mechanisms Departments, and pay you too! (MACHINERY, 148 Lafayette St., New York 13.)

But Is It Safe to Take the Test?

DuPont has taken extensive measures for their employes' welfare, all explained in a booklet covered in "dazzle" black and yellow striping. One of the novel experiments being made is to determine the safe amount of work for employes—there is, for instance, a picture of a young lady riding a special bicycle wired (the young lady) to send to technicians the record of her blood pressure and pulse rate.

Sounds Mellow

The *N. Y. Journal of Commerce* tells us that the use of ultrasonic waves will make possible the drinking of whisky that has matured for only a few minutes. We quote: "The waves will not age you any faster, but they do wonders for the liquor." Who cares about the liquor?

$20 Per Inch

In your hunt for a gift for possibly a draftsman friend of yours we hope you didn't overlook this terrific trifle—a 14K gold ruler, 1 foot long, 5/8 inch wide, folding to 4 inches, and having metric and inch measures. The cost? A mere $200 plus 20 per cent tax at a New York City department store.

Engineer on Educational Leave — AKITAKA FUJITA says, "I am an engineer and I have come to America as a State Department exchange student believing the industrial cooperation between America and Japan is most important for securing truly world peace." Working for Sumitomo Metal Industries, Ltd., in Osaka, among the five largest companies in Japan, Mr. Fujita was given a year's leave of absence. He is one of 300 men who came over here under the sponsorship of our State Department, and is at Columbia University studying metallurgy. Among Mr. Fujita's early American experiences was playing golf (a game he had never played in Japan but, noting the gleam in his eye, we feel sure he will), having mumps (which necessitated a stay of two weeks in a midwest hospital), and enjoying Thanksgiving dinner in a Pennsylvania Dutch home (where he turned to and helped dry dishes, American style). Akitaka—translated meaning Alexander the Great—is married and has two young daughters in Japan, Ureka (Intelligence) and Umiko (Beauty). Mr. Fujita is an ardent reader of MACHINERY, and it was by writing to our Editor for technical information back in October, 1950, that he was encouraged to achieve his great ambition of studying in the United States.

News OF THE INDUSTRY

California

W. G. HOFFMAN has been appointed West Coast representative of the Aetna-Standard Engineering Co., of Pittsburgh, Pa., his headquarters being in San Mateo, Calif. Mr. Hoffman had retired in 1951 from the United States Steel Co., completing a fifty-year service record.

VICKERS INCORPORATED, Detroit, Mich., has expanded the El Segundo Division, Los Angeles, Calif., to meet the specialized hydraulic design needs of West Coast manufacturing plants.

JOSEPH B. RICE, JR., has become general manager and chairman of the board of Beckman & Whitley, Inc., San Carlos, Calif., manufacturers of meteorological instruments.

ARMSTRONG BROS. TOOL CO., Chicago, Ill., announces the removal of its Pacific Coast warehouse and sales office to 67 Eleventh St., San Francisco, Calif.

HAROLD C. OLSON has been named works metallurgist in the Los Angeles, Calif., plant of the Lindberg Steel Treating Co., Chicago, Ill.

DIAMOND MACHINE TOOL CO., Pico, Calif., has opened a sales office at 2816 S. Santa Fe Ave., Los Angeles, Calif.

Illinois and Missouri

HARRY L. EMERSON, vice-president in charge of manufacturing of the Rockford Clutch Division, Rockford, Ill., of the Borg-Warner Corporation, Chicago, Ill., has been appointed president and general manager of this division. Mr. Emerson has been with Rockford Clutch for over thirty years serving in many capacities, including those of chief inspector, plant superintendent, and works manager. He succeeds ARCH A. WARNER, who has been made president of the Mechanics Universal Joint Division, also of Rockford. Mr. Warner assumes the position left by G. C. GRIDLEY, who has retired as president of the Mechanics Universal Joint Division, but will remain with the corporation in a consulting capacity. Also announced was the promotion of G. L. CHRISTIANSON to the position of executive vice-president of the Rockford Clutch Division. He was formerly vice-president and assistant general manager.

DAVID D. WALLACE, assistant treasurer of the Clearing Machine Corporation, Chicago, Ill., press manufacturer, has been appointed to manage the corporation's operations in London, England. Mr. Wallace, who has been associated with the Clearing Machine Corporation for eleven years, will supervise manufacturing as well as sales in his new post.

PAUL J. ISVOLT has been named district sales manager in Cincinnati, Ohio, for the Acme Steel Products Division of the Acme Steel Co., Chicago, Ill. Mr. Isvolt replaces NEIL L. ANDERSON who was recently transferred to the Chicago office.

K. C. MACKAY and E. U. T. BERTHELSEN have been appointed assistants to the vice-president and manager of the Shakeproof Division, Illinois Tool Works, and will have offices at Shakeproof's new plant in Elgin, Ill.

CARTER CONTROLS, INC., a company manufacturing hydraulic and pneumatic equipment, was recently formed by J. CARTER MILLER. The new company will carry on manufacturing at 2800 Bernice Road, Lansing, Ill.

JOHN F. NEWHARD has been named production control manager of the Shakeproof Division of the Illinois Tool Works, Chicago, Ill. Mr. Newhard will be located at the plant in Elgin, Ill.

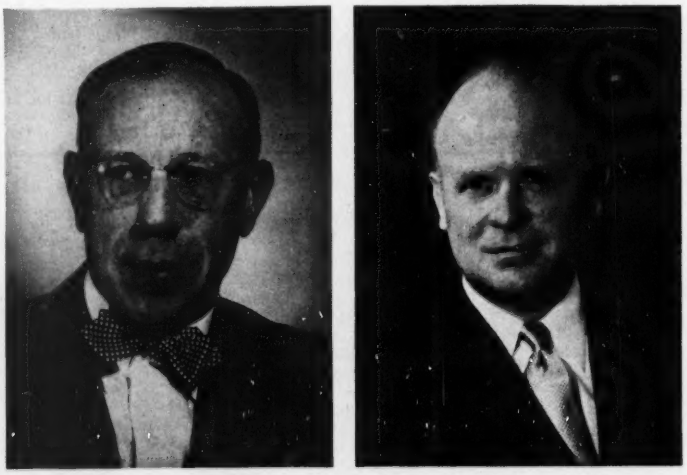
C. A. WALMSLEY has been made district manager in charge of the St. Louis, Mo., car plant of the American Car & Foundry Co., New York City, succeeding T. G. Shipley, who has retired after more than forty years of service.

ALBERT L. HUNT has been appointed manager of industrial sales for the National Bearing Division, St. Louis, Mo., of the American Brake Shoe Co., New York City.

Michigan

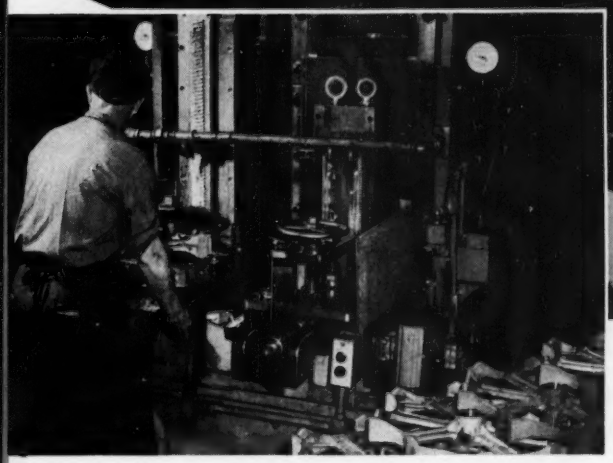
HARRY C. MASON has been appointed district manager in New York City for Whitman & Barnes, Plymouth, Mich., succeeding GEORGE W. CLARKSON, who recently resigned. Mr. Mason was formerly a sales and service engineer with headquarters at the Chicago office. JOSEPH RODECKER, who was sales representative for the company in the Buffalo, N. Y., area, has been transferred to San Francisco, Calif., taking over the territory previously covered by the late B. F. ROHDE.

JOHN E. G. KLINE, executive engineer for the Micromatic Hone Corporation, Detroit, Mich., has been promoted to the post of vice-president in charge of process development and patents. He has been with the corporation since 1937. In that year, Micromatic acquired the tool division



(Left) John E. G. Kline, vice-president in charge of process development and patents for the Micromatic Hone Corporation. (Right) Douglas T. Peden, vice-president in charge of research

MASSEY-HARRIS maintains the only full-scale test track of its type in the implement industry. The track gives these combines more punishment in hours than normal service does in years.



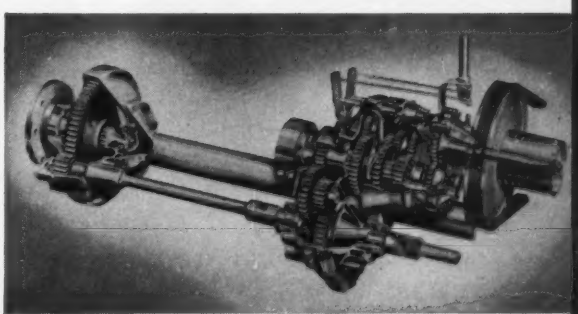
SUNOCO EMULSIFYING CUTTING OILS are used in machining many precision parts. Being broached here are cylinder ends which hold the thresher bars. It is their function to maintain the thresher bars in close alignment with the concave bars to provide efficient operation.

MANY PARTS OF NEW MASSEY-HARRIS COMBINES MACHINED WITH SUN CUTTING OILS

The new Massey-Harris Self-Propelled Combines are precision mechanisms. They are as perfect as a century of experience, modern engineering and production can make them. Sunoco Emulsifying Cutting Oils are used in machining close tolerance parts; Sunicut Cutting Oils are used where an emulsifying oil is not suitable.

"Test it on the track—prove it in the field." That's the Massey-Harris way of insuring the quality of their products. Sun products play an important part in maintaining their high standards.

To learn the right cutting oils and lubricants for your job, consult a Sun representative. You will find his services practical, reliable and complete. Write or call SUN OIL COMPANY, Philadelphia 3, Pa.



SUN LUBRICANTS are used in many of these self-propelled combines for gear and crankcase lubrication. Massey-Harris selected these Sun products because they meet their unusually high standards.

SUN INDUSTRIAL PRODUCTS

SUN OIL COMPANY, PHILADELPHIA 3, PA. • SUN OIL COMPANY, LTD., TORONTO AND MONTREAL

SUNOCO®

of the Hutto Engineering Co., of which Mr. Kline was consulting engineer, and he then became chief engineer of the corporation. Later he was appointed executive engineer. Also announced was the appointment of DOUGLAS T. PEDEN to the position of vice-president in charge of research. Mr. Peden joined the corporation in 1938, and now has a record of over thirty years' experience in machine tool design and development.

MICHAEL PINTO is the new owner and president of the Pioneer Engineering & Mfg. Co., Inc., Detroit, Mich., succeeding A. M. SARGENT. Mr. Sargent founded the company and served as its president since 1930, but is now retiring. CLYDE MOONEY, who has been chief engineer of the Pioneer organization since 1945, has been promoted to the post of general manager in charge of operations.

HERBERT T. ANDREW has been named a salesman with headquarters in Detroit, Mich., for the Standard Pressed Steel Co., Jenkintown, Pa. His territory includes most of Michigan, northwestern Ohio, and northern Indiana.

HARTFORD SPECIAL MACHINERY CO., Hartford, Conn., announces the appointment of the BERT CARPENTER CO., Birmingham, Mich., as distributor of automatic drilling and tapping machinery in eastern Michigan.

F. P. STRIETER has been named assistant superintendent of the die-casting department of the Dow Chemical Co., Midland, Mich. Mr. Strieter was formerly chief of the castings section in the company's metallurgical laboratories.

HARRY I. HANSEN has been appointed district manager in Detroit, Mich., for the Electrochemicals Department of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., succeeding MORELL MAREAN.

HUCK MFG. CO., Detroit, Mich., has become distributor in the United States and Canada for the Deutsch drive pin blind rivet, manufactured by the DEUTSCH CO., Los Angeles, Calif.

SUNDBERG-FERAR, industrial designers, recently opened their new building at 1204 S. Woodward Ave., Royal Oak, Mich.

New England

COLUMBIA MACHINERY & ENGINEERING CORPORATION, New York City, announces the acquisition of all of the assets and manufacturing rights of the BRIDGEPORT SAFETY EMERY WHEEL CO., Bridgeport, Conn., and the DIAMOND MACHINE CO., Stratford, Conn. The corporation plans to integrate the two Connecticut companies for the time being, with its Hamilton, Ohio, Division. Although the Columbia Machinery & Engineering Corporation will continue the manufacture of the full Bridgeport line of medium and heavy hydraulic face grinders and other grinders, its activities in connection with the Diamond Machine Co. will be limited to field service for the present.

EDGAR G. SEYBOLD, vice-president of Hendey Machine Co., Inc., Torrington, Conn., has been made executive vice-president and director. Two new executives have also joined the company—BERNARD SASSEN, who becomes vice-president in charge of engineering; and HELGE G. HOGLUND, vice-president in charge of sales. Mr. Sassen was with the Monarch Machine Tool Co., of Sidney, Ohio, where he was in charge of new product design and the mechanical and electrical laboratory; Mr. Hoglund was associated with the Heald Machine Co., Worcester, Mass., where he was general sales manager.

RICHARD F. V. STANTON was recently elected president and general manager of the Whitney Chain Co., Hartford, Conn. Mr. Stanton had been vice-president in charge of manufacturing at the American Machine & Foundry Co. for the last four years. W. H. WHITNEY, who was president of the Whitney Chain Co. for a period of thirteen years, continues as chairman of the board of directors.

PRATT & WHITNEY AIRCRAFT, DIVISION OF UNITED AIRCRAFT CORPORATION, East Hartford, Conn., recently opened a plant located at Washington Ave., North Haven, Conn. The plant itself occupies an area of 700,000 square feet, the major part of which will be devoted to manufacturing aircraft engines.

BASCO MFG. CO., 5 Woodside St., Stamford, Conn., has been organized for the purpose of manufacturing Basco sheet steel separators, formerly marketed by D. C. CANFIELD of New Britain, Conn.

BACON INDUSTRIES, INC., has been organized to produce O-rings, gaskets, and similar products, formerly manufactured by the FREDERICK S. BACON LABORATORIES, which becomes the parent organization. The new company will maintain manufacturing facilities at 192 Pleasant St., Watertown, Mass.

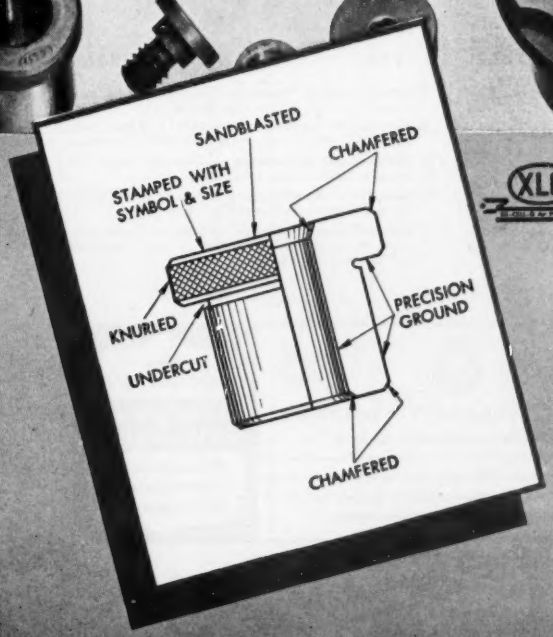
NORTON CO., Worcester, Mass., announces the appointment of the following field engineers: RODERICK L. SMITH, in the Chicago, Ill., territory;

(Left to Right) Edgar G. Seybold, executive vice-president of Hendey Machine Co., Inc.; Bernard Sassen, vice-president in charge of engineering; and He'ge G. Hoglund, vice-president in charge of sales

Look for These Features in Drill Bushings

EX-CELL-O HAS THEM ALL

- **MATERIAL**—premium grade tool steel selected for greatest wear resistance.
- **FINISH**—precision ground inside and out, and under the head for perfect bearing.
- **CONCENTRICITY**—assured by grinding on arbors after the holes are finished.
- **HARDNESS**—hardened to 62-64 Rockwell "C" on accurately controlled equipment.
- **UNIFORMITY**—of material, dimensions, finish, and hardness assure accuracy, long life for both bushings and tools.
- **PROMPT DELIVERY**—from stocks of standard sizes in Detroit, New York, Los Angeles, and Toronto, Canada.
- **PREFERRED**—largest bushing users in the country are Ex-Cell-O customers.



Your purchasing and engineering departments should have copies of this Ex-Cell-O Bushing Catalog No. 35371. Just ask for the number of copies you would like.

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • CUTTING TOOLS
RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT
AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

A Starrett DOUBLE FEATURE
MICROMETER CALIPERS with...
DIRECT FEEL plus FRICTION THIMBLE
OR RATCHET STOP
No. 231
0 to 1" range .0001" graduation
With Ratchet Stop and Lock Nut
No. 231F (at top)
0 to 1" range .0001" graduation
With Friction Thimble and Lock Nut

Only STARRETT offers this double feature in micrometer design! You can choose the micrometer that best suits your needs — either with *ratchet stop* or *friction thimble.* Both give uniform contact pressure on every measurement — insuring the same accuracy every time independent of feel. Both also provide "direct feel"—a plus feature desired by many mechanics for "feeling" certain measurements.

Ratchet stop micrometers have a convenient ratchet stop at the end of the micrometer while the thimble itself is used for "direct feel". *Friction thimble micrometers* have a friction control mechanism built into the upper section of the thimble "right under your thumb"; permitting easy one-hand operation; lower section of the thimble is integral with the spindle for "direct feel" measurements.

For consistent accuracy in precision measuring, use Starrett *Satin Chrome* Micrometers . . . they're ideal for all inspection and quality control applications. Your industrial distributor will give you prompt, dependable, quality service.

INSIST ON THESE BIG Starrett FEATURES FOR BETTER, FASTER, PRECISION MEASURING

1 **No-glare satin chrome finish** — On Thimble and Sleeve of all Micrometers and also on Frame of all Full Finish Micrometers. Easy to Read — Eliminates Squinting and Eye Strain. Highly Resistant to Stains, Corrosion and Wear.

2 **Hi-micro mirror lapped finish** — On Faces of Anvil and Spindle. Insures More Accurate Measurements. Also Available with Tungsten Carbide Faces at slight additional cost.

3 **One-piece spindle** — Extra-Rigid Integral Construction for Long, Accurate Life.

4 **Extra hard threads** — Special High Carbon Steel Gives Harder Threads Which are Hardened, Stabilized and Ground from the Solid to Insure Lasting Precision.

5 **Tapered frame** — Permits Measurements in Narrow Slots and Tight Places. Standard on All Full Finish Outside Micrometers.

6 **Rigid, one-piece frame** — Barrel is Integral with Frame for Maximum Rigidity, Accuracy and Long Life.

7 **Easy to read** — Large Diameter Thimble and Sleeve with Distinct Black Figures and Graduations Against Satin Chrome Finish. Measurements Easy to Read Under Any Illumination.

8 **Quick reading figures** — Every Graduation Numbered For Quick, Positive Identification.

9 **Convenient decimal equivalents** — of 8ths, 16ths, 32nds and 64ths on Frame or Thimble of All Micrometers.

10 **Quick, easy adjustment** — Only Two Simple Adjustments Maintain Starrett Accuracy.

11 **Lock Nut** — Permits Locking of Spindle At Any Reading. Available at Slight Additional Cost.

12 **Ratchet stop or friction thimble** — Permits Consistent Measurements Independent of "Feel". Available At Slight Additional Cost.

STARRETT TOOLS

TRADE MARK Starrett REG. U.S. PAT. OFF.

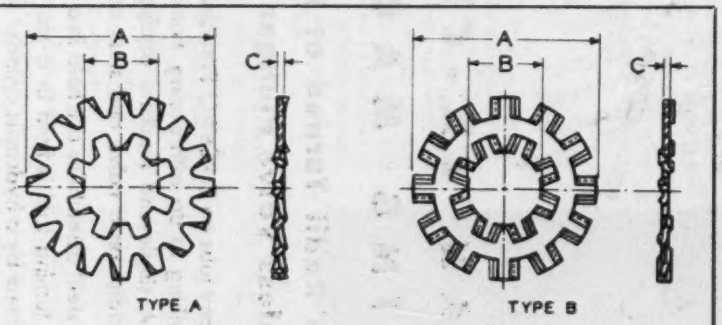
SINCE 1880
WORLD'S GREATEST TOOLMAKERS

THE L. S. STARRETT COMPANY
Athol, Massachusetts, U. S. A.

MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS, BAND SAWS and BAND KNIVES

Buy THROUGH YOUR INDUSTRIAL DISTRIBUTOR
Prompt delivery
Dependable service
Quality products

DIMENSIONS OF AMERICAN STANDARD INTERNAL-EXTERNAL TOOTH LOCK-WASHERS—1



Internal-External Tooth Lock Washers

Size, Number	A Outside Diameter, Inch		B Inside Diameter, Inch		C Thickness, Inch	
	Max.	Min.	Max.	Min.	Max.	Min.
4	0.475	0.460	0.123	0.115	0.021	0.017
	0.510	0.495			0.021	0.017
	0.610	0.580			0.021	0.017
6	0.510	0.495	0.150	0.141	0.028	0.023
	0.610	0.580			0.028	0.023
	0.690	0.670			0.028	0.023
8	0.610	0.580	0.176	0.168	0.034	0.028
	0.690	0.670			0.034	0.028
	0.760	0.740			0.034	0.028
10	0.610	0.580	0.204	0.195	0.034	0.028
	0.690	0.670			0.040	0.032
	0.760	0.740			0.040	0.032
	0.900	0.880			0.040	0.032
12	0.690	0.670	0.231	0.221	0.040	0.032
	0.760	0.725			0.040	0.032
	0.900	0.880			0.040	0.032
	0.985	0.965			0.045	0.037

MACHINERY'S Data Sheet No. 721, January, 1953

Approved by American Standards Association as ASA B27.1

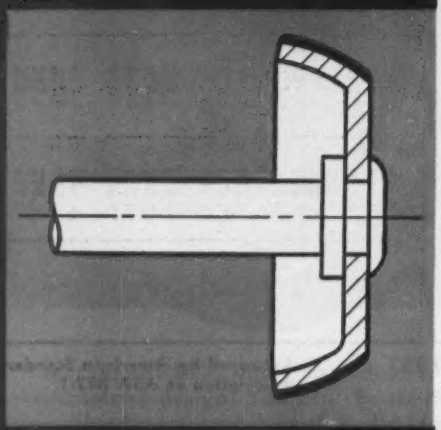
DIMENSIONS OF AMERICAN STANDARD INTERNAL-EXTERNAL TOOTH LOCK-WASHERS—2

Size, Inch	A Outside Diameter, Inches		B Inside Diameter, Inch		C Thickness, Inch	
	Max.	Min.	Max.	Min.	Max.	Min.
1/4	0.760	0.725	0.267	0.256	0.040	0.032
	0.900	0.880			0.040	0.032
	0.985	0.965			0.045	0.037
	1.070	1.045			0.045	0.037
5/16	0.900	0.865	0.332	0.320	0.040	0.032
	0.985	0.965			0.045	0.037
	1.070	1.045			0.050	0.042
	1.155	1.130			0.050	0.042
3/8	0.985	0.965	0.398	0.384	0.045	0.037
	1.070	1.045			0.050	0.042
	1.155	1.130			0.050	0.042
	1.260	1.220			0.050	0.042
7/16	1.070	1.045	0.464	0.448	0.050	0.042
	1.155	1.130			0.050	0.042
	1.260	1.220			0.055	0.047
	1.315	1.290			0.055	0.047
1/2	1.260	1.220	0.530	0.512	0.055	0.047
	1.315	1.290			0.055	0.047
	1.410	1.380			0.060	0.052
	1.620	1.590			0.067	0.059
9/16	1.315	1.290	0.596	0.576	0.055	0.047
	1.430	1.380			0.060	0.052
	1.620	1.590			0.067	0.059
	1.830	1.797			0.067	0.059
5/8	1.410	1.380	0.663	0.640	0.060	0.052
	1.620	1.590			0.067	0.059
	1.830	1.797			0.067	0.059
	1.975	1.935			0.067	0.059

MACHINERY'S Data Sheet No. 722, January, 1953

Approved by American Standards Association as ASA B27.1

Ex-Cell-O Style 2112-A Precision Boring Machine.



Partial sectional view of assembly shows the operation in heavy lines.

Precision Turning

ON AN EX-CELL-O BORING MACHINE

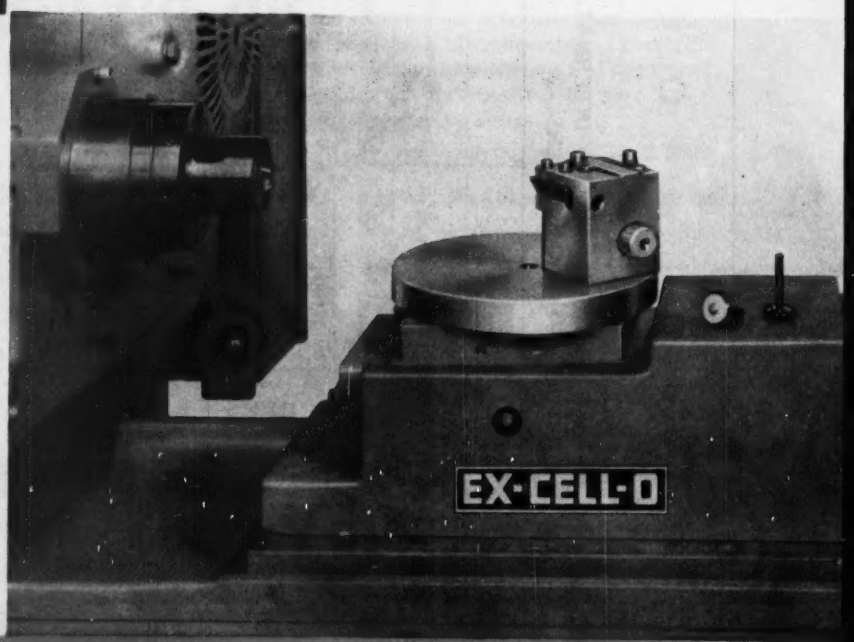
Accurate Radii Turned at High Speed on Stainless Valve Plunger Assemblies

There are many jobs on Ex-Cell-O Precision Boring Machines that have nothing to do with boring. For example, here's a Style 2112-A single-end machine equipped for precision turning the radius on a valve and stem assembly.

The stainless steel assemblies are held in a collet chuck on the spindle. The turning tool is held in a tool block on a turret which is actuated by a hydraulic cylinder through a rack and pinion. Net production is 109 pieces per hour.

For further information on the many uses to be made of Ex-Cell-O Precision Boring Machines, see your local Ex-Cell-O representative or write for Bulletin 31205.

Close-up of spindle and tool block on Ex-Cell-O Style 2112-A Precision Boring Machine equipped for precision turning an accurate radius.



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EX-CELL-O for PRECISION

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CORPORATION

DETROIT 32, MICHIGAN

52-14

MANUFACTURERS OF PRECISION MACHINE TOOLS • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS
DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

and PHILIP H. THRESHIE, JR., in the Pacific Coast district.

SIMMONDS AEROCESSORIES, INC., of Tarrytown, N. Y., has begun construction of a plant at Vergennes, Vt., for the manufacture of aircraft electronic and mechanical equipment.

New Jersey

HYATT BEARINGS DIVISION, GENERAL MOTORS CORPORATION, Harrison, N. J., has established a Railroad Sales Division at Harrison, which has been formed to handle railroad work exclusively. F. U. NAUGHTON, JR., who was manager of eastern sales, will head the new Division as manager of railroad sales. E. P. O'NEILL succeeds Mr. Naughton as manager of the Eastern Sales Division.

J & S TOOL CO., INC., East Orange, N. J., is building a plant at Livingston, N. J., which will expand its present facilities by approximately three times. The location of the plant is at 644 W. Mt. Pleasant Ave., in Livingston.

ADAMAS CARBIDE CORPORATION, Harrison, N. J., has made plans to construct a 20,000 square foot plant for the production of tungston-carbide tool tips, dies, wear parts, and powder, in Kenilworth, N. J.

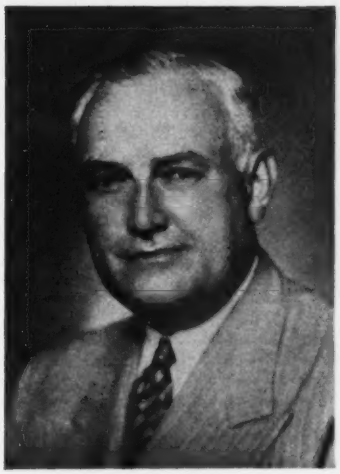
PAUL E. KIRCHARTZ has formed a company, METAL FINISH, INC., which will be devoted to precision metal-finishing. The new company is located at 410 Frelinghuysen Ave., Newark 5, N. J.

GEORGE PETERSON, JR., has become director of aircraft sales at the Camden Forge Co., Camden, N. J. Mr. Peterson was formerly with the Riverside Metal Co.

New York

UNITED STATES STEEL CORPORATION, New York City, announces the following executive promotions: CLIFFORD F. HOOD has been elected president of the corporation and a member of the board of directors; HARVEY B. JORDAN has become executive vice-president — operations; WALTER F. MUNFORD has been appointed president of the American Steel & Wire Division of United States Steel; and HOWARD E. ISHAM has been elected vice-president and treasurer, succeeding MAX D. HOWELL, who is retiring.

GUY J. COFFEY has been elected president of the Chicago Pneumatic Tool Co., New York City, succeeding the late W. L. LEWIS. Mr. Coffey has been with the company for nearly twenty years. In 1945, he was elected vice-president in charge of sales and



Guy J. Coffey, recently elected to the presidency of the Chicago Pneumatic Tool Co.

a director of the company. H. A. JACKSON, who had been acting president since the death of Mr. Lewis, will continue as chairman of the board and chief executive officer. Also announced at this time were the appointments of THOMAS P. HARRIS and JAMES F. HUVANE as vice-presidents.

GEORGE W. STAMM, manager of the Cleveland, Ohio, office of the Crucible Steel Company of America, New York City, has been appointed to the newly created post of assistant to the vice-president in charge of sales. Mr. Stamm will be located in the Pittsburgh, Pa., office of the company. ROBERT C. KUHN, who was assistant manager of the Cleveland branch, has been promoted to manager, succeeding Mr. Stamm.

DR. WILLIAM H. MILLETT has been transferred from the Tonawanda, N. Y., laboratories of the Linde Air Products Co., a division of the Union Carbide and Carbon Corporation, New York City, to the Carbide and Carbon Chemicals Co., another division of the corporation. Dr. Millett will be associated with the Special Products Division of the Carbide and Carbon Chemicals Co. in New York City.

KELVIN SYSTEMS CORPORATION, New York City, has been appointed distributor for the entire Scrivener line of precision grinding machines. Made in England for many years, the line includes centerless grinders, duplex grinders, surface grinders, an end-forming machine, and a profile-turning lathe.

GIBNEY-COFFMAN CORPORATION, Buffalo, N. Y., has been appointed representative for the BRAD FOOTE GEAR WORKS, INC., Cicero, Ill., and the SUPERIOR STEEL & MALLEABLE CASTINGS CO., Benton Harbor, Mich. The Gibney-Coffman concern moved recently to 2107 Kensington Ave., Buffalo.

G. KRAUSE was recently made chief designer of the Loewy Construction Co., Inc., New York City, subsidiary of Hydropress, Inc., in charge of the U.S.A.F. heavy press program. ADAM ZANDEL was named executive engineer in charge of administration of the engineering department.

SHEPARD NILES CRANE & HOIST CORPORATION, Montour Falls, N. Y., is observing its fiftieth anniversary. Since the corporation's organization in 1903, it has engineered and built more than 110,000 electric hoists and 25,000 electric traveling cranes.

R. A. HAMILTON, formerly with the Lockheed Aircraft Corporation, Burbank, Calif., has become associated with the Farrand Optical Co., Inc., New York City, in the capacity of consulting engineer in the Optical Tooling Division.

DR. J. H. BRUUN has joined the Hooker Electrochemical Co., Niagara Falls, N. Y., as director of research. Dr. Bruun was with the General Aniline & Film Corporation for the last ten years.

PERRY T. EGBERT was recently elected president of the American Locomotive Co., Schenectady, N. Y., while WILLIAM S. MORRIS was made executive vice-president.

Ohio

WARREN G. ROSENDAHL has joined the Columbia Machinery & Engineering Corporation, Hamilton, Ohio, in the capacity of director of manufac-

Warren G. Rosendahl, director of manufacturing at Columbia Machinery & Engineering Corporation

turing. Mr. Rosendahl was formerly assistant general manager of the Hamilton Division of the Clearing Machine Corporation. In his new position, he will be responsible for coordinating company manufacturing operations, including supervision of the New Products Division. WILLIAM O. STAUBITZ has become associated with the company as assistant sales manager. Mr. Staubitz was previously associated with the General Electric Co. at Lockland, Ohio, where he served as machine tool coordinator in the jet engine division.

RELIANCE ELECTRIC & ENGINEERING Co., Cleveland, Ohio, announces the following personnel changes: WILLIAM C. MCCONNELL, sales engineer at Detroit, Mich., has been transferred to Cleveland, Ohio; ROBERT B. REED, who was located at Birmingham, Ala., for the last three years, has been assigned to take over Mr. McConnell's former sales engineering duties in Detroit; and REX T. WILLARD has replaced Mr. Reed in the Birmingham area. Mr. Willard was at the Atlanta, Ga., sales office, which will remain his headquarters.

LODGE & SHIPLEY Co., Cincinnati, Ohio, announces that it has sold the assets of its Choremaster (Special Products) Division to WEBER ENGINEERED PRODUCTS, INC., also of Cincinnati. The Choremaster Division is located at 800 Evans Street in that city. In the future, Lodge & Shipley facilities will be devoted entirely to lathe developments and expanded research in the field of metal turning with which it has been identified for over sixty years.

J. S. ROSCOE has been appointed executive vice-president in charge of business administration by the Lincoln Electric Co., Cleveland, Ohio. Mr. Roscoe has been director of purchasing since 1951, and, prior to that, was in the company's sales engineering department in various sections of the country. He has been active in the arc welding field for twenty-eight years.

CLEVELAND BROACH Co., INC., a company formed as an affiliate of the CUTTER SALVAGE CORPORATION, Cleveland, Ohio, is occupying a new plant located at 1061 Lakeland Blvd., Euclid, Ohio. The company will produce and service broaches, broach inserts, bars, and fixtures.

DENISON ENGINEERING Co., Columbus, Ohio, manufacturer of oil hydraulic equipment, has opened an office at 1200 Bissonnet, Houston, Tex., as headquarters for the company's southwestern sales and service operations. DENISON NEALE will be manager of the branch.

ERIC BRIERLEY has been made sales engineer in the Cleveland, Ohio, office of the Reed-Prentice Corporation, Worcester, Mass. Mr. Brierley has been assistant to the sales manager at the company's main office for the last four years. In his new position he will be a member of the Cleveland sales staff, of which D. G. EATON is sales manager.

JACK J. ROWE has been appointed district manager in Cleveland, Ohio, for DeWalt Inc., Lancaster, Pa., manufacturer of power cutting tools, and a subsidiary of the American Machine & Foundry Co.

WILLIAM S. RICHARDSON, vice-president of the B. F. Goodrich Co., Akron, Ohio, has been elected executive vice-president and a director.

RAHN GRANITE SURFACE PLATE Co. has added a wing to its plant in Dayton, Ohio, which will house its research laboratory.

Pennsylvania

JOHN S. ROLLER has been appointed assistant general sales manager of Firth Sterling Inc., Pittsburgh, Pa. Mr. Roller was formerly vice-president and general manager of the Method X Co., a Firth Sterling affiliate devoted to the research and development of an electro-mechanical process of machining heretofore unmachinable materials. Recently the Method X manufacturing rights were sold, thereby permitting Mr. Roller to take up his present duties. PAUL PORTERFIELD has been made general manager of the Method X Co., succeeding Mr. Roller. DON P. CARR has been named assistant sales manager of the Steel Division. Before his appointment, Mr. Carr was a salesman for Firth Sterling.

J. R. WEAVER has been made manager of manufacturing and engineering for the Springfield, Mass., plant of the Electric Appliance Division of the Westinghouse Electric Corporation, Pittsburgh, Pa. Mr. Weaver, who was on the corporation's manufacturing staff in Pittsburgh, will succeed C. B. DICK, former works manager of the Springfield plant, who was transferred to Pittsburgh.

BALDWIN-LIMA-HAMILTON CORP., Philadelphia, Pa., announces that the Eddystone, Pa., sales organization has been divided into two groups to be known as the transportation sales department and the industrial sales department. LEWIS A. HESTER has been appointed general sales manager of the former, and ANDREW LISTON, general sales manager of the latter.

DYNAMATIC CORPORATION, Kenosha, Wis., manufacturer of variable-speed drives, and subsidiary of the EATON MFG. Co., Cleveland, Ohio, recently announced the opening of an office at 4525 N. Broad St., Philadelphia, Pa. EUGENE POHL, who is joining the corporation, will be district manager there.

ALUMINUM COMPANY OF AMERICA, Pittsburgh, Pa., recently announced plans for building a $3,000,000 fabricating plant in Lancaster, Pa., for the production of aluminum screw machine products, fasteners, rivets, and nails.

HENRY K. MOORE has joined the Bellows Co., Akron, Ohio, as field engineer. His headquarters will be at the Philadelphia, Pa., office.

Texas and Florida

CLECO DIVISION OF THE REED ROLLER BIT Co., Houston, Tex., recently announced the appointment of the following distributors: GRANT & Co., 2144 E. 7th St., Los Angeles, Calif.; H. N. CROWDER, JR., Co., 446 Union St., Allentown, Pa.; and PONSFORD EQUIPMENT Co., 408 Bassett Tower, El Paso, Tex.

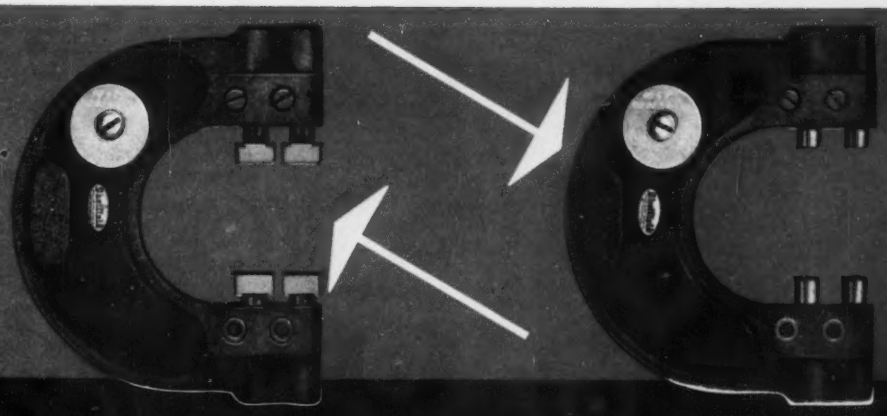
THERON D. WHIDDEN, JR., has been appointed southeastern representative by the UTICA DROP FORGE & TOOL CORPORATION, Utica, N. Y. Mr. Whidden's headquarters are at 1110 McKinley Court, Jacksonville, Fla.

Wisconsin and Minnesota

WILBERT G. PRASSE has been elected president of the Oilgear Co., Milwaukee, Wis., manufacturer of fluid power pumps, motors, transmissions, cylinders, and valves. Mr. Prasse, who succeeds the late George H. Fobian, started work for the company in the machine assembly department in 1927, and a year later became eastern sales representative. In 1941, he was made general sales manager of the company, and four years later, vice-president and director. Succeeding Mr. Prasse as vice-president is FRANK G. KUHAGEN, who was also elected director of the company. At the time of his promotion Mr. Kuhagen was sales manager. He has been with the company for twenty-seven years.

YATES-AMERICAN MACHINE Co., Beloit, Wis., has announced the acquisition and transfer to Beloit of the manufacturing facilities of the BIG FOUR CARBIDE TOOL Co., Cincinnati, Ohio, manufacturer of "Big Four" carbide-tipped saws and other carbide-tipped cutting equipment.

KSM PRODUCTS, INC., Merchantville, N. J., manufacturers of studs and equipment for electric-arc stud welding, have announced the opening of an engineering office in Milwaukee, Wis. JACK HARRIS has been appointed district engineer there.



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NEW PRICES STOCK DELIVERIES

The magnitude of current defense procurement pyramided on unprecedented civilian needs has made it practicable for Sheffield to more than triple its manufacturing facilities for standard A.G.D. gages . . . and to put them on a mass production basis.

Mass production methods have reduced manufacturing costs as they normally do. Mass production coordination has made it possible to build up complete stocks of standard gages and maintain these stocks at full quota.

Sheffield's policy is to pass its manufacturing savings on to you in reduced gage prices. Thus you can now have Sheffield Quality at a low price and without waiting.

See your representative or write us. Your quotation will go forward as soon as we know your requirements. Get them in the mail today.

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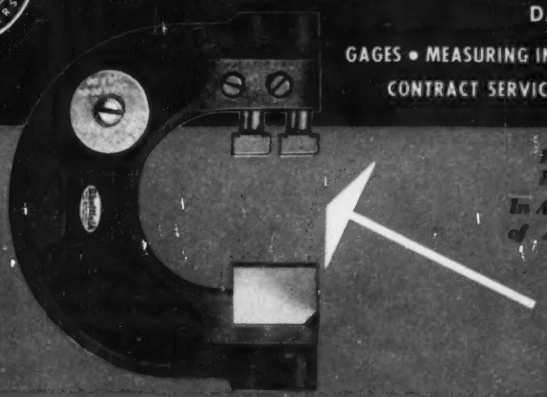

REPRESENTATIVES IN PRINCIPAL COUNTRIES

In Australia, the Sheffield Corporation of Australia Pty. Ltd., Melbourne

(Left) Morris L. Hutchens, chief engineer of the Special Machinery Division of Kearney & Trecker Corporation; and (right) Walter J. Hubbes, superintendent of the Division

KEARNEY & TRECKER CORPORATION, Milwaukee, Wis., announces the appointments of the following men in the newly organized Special Machinery Division, who will direct the activities of the corporation's new plant which will be finished next summer and which will house the Division: MORRIS L. HUTCHENS, chief engineer; WALTER J. HUBBES, superintendent of the Division's manufacturing operation; HAROLD W. KIPPERS, sales manager; and JOHN P. BUNCE, staff assistant to the manager of the Division.

STANDARD TOOL CO., Cleveland, Ohio, has awarded a cutting tool franchise to the COOPER TOOL & ENGINEERING Co., which is located at 4221 Excelsior Blvd., Minneapolis, Minn. The Cooper Tool & Engineering Co. will handle the complete Standard line of cutting tools including twist drills, reamers, milling cutters, hobs, and end-mills.

Tool Ground to Rough-Ream, Finish-Ream, and Burnish in One Operation

A new method of grinding "flute long" carbide-tipped reamers which enables users to rough- and finish-ream and burnish in one operation has been developed by the Super Tool Co., Detroit, Mich. The reamer is ground 0.005 inch to 0.010 inch under size the first 1/2 inch of the entering end, and then builds up to finish-ream size as indicated in Fig. 1. Above the finish-ream section, lands are circular ground for burnishing to produce a micro finish. The "flute long" reamer is carbide-tipped the full length of the flute.

Reamers ground by this new method have proved their value in production tests by giving a 25 micro-inch finish for as many as 1000 pieces of malleable iron parts such as shown in Fig. 2. With reamers as previously ground, the finish could not be held on these parts for more than a few pieces.

* * *

Survey Shows Industry Can Improve Use of Engineers

The majority of American industrial companies are not getting the best "mileage" from their engineering staffs. How almost 500 companies employing some 106,000 engineers are meeting this problem in the face of a shortage of engineers is disclosed in a recent report entitled "How to Improve the Utilization of Engineering Manpower."

The report, prepared by the National Society of Professional Engineers, is based on a nation-wide survey. It points out that industry could use engineers more effectively by analyzing staff assignments and standardizing many routine engineering jobs so that they could be done by supporting personnel. This would leave the engineers free to concentrate on creative work. Other methods which have proved successful in using engineering manpower more efficiently are also suggested.

One large chemical company found that new engineers move into higher-level engineering work faster and do more effective work as a result of a carefully planned indoctrination program. In an eastern communications laboratory, high school and liberal arts college graduates are trained for careers as technical aides to engineers. A jet-engine manufacturer has set up an engineering planning group to take over estimating, scheduling, and budget control on engineering projects. Centralization of top-level engineering and clear-cut delegation of authority and responsibility are reported as important steps in employing engineering personnel most advantageously.

Copies of the report can be purchased from the national headquarters of the Society, at 1121 Fifteenth St., N.W., Washington 5, D. C.

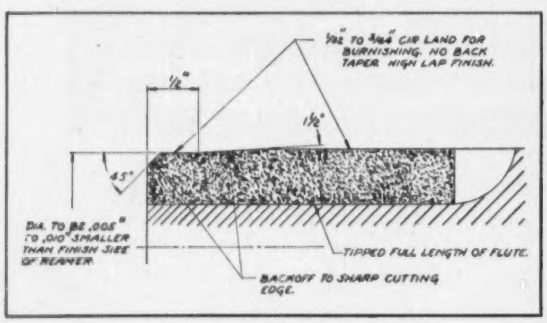
.002" TO .004" CIR LAND FOR BURNISHING. NO BACK TAPER. HIGH LAP FINISH.
1/2"
1 1/2"
45°
DIA. TO BE .005" TO .010" SMALLER THAN FINISH SIZE OF REAMER.
TIPPED FULL LENGTH OF FLUTE.
BACKOFF TO SHARP CUTTING EDGE.

Fig. 1. Diagram showing method of grinding blade of tool for rough- and finish-reaming as well as burnishing in one operation

Fig. 2. Example of production work with hole finished by carbide-tipped reamer, the blades having been ground as shown in Fig. 1

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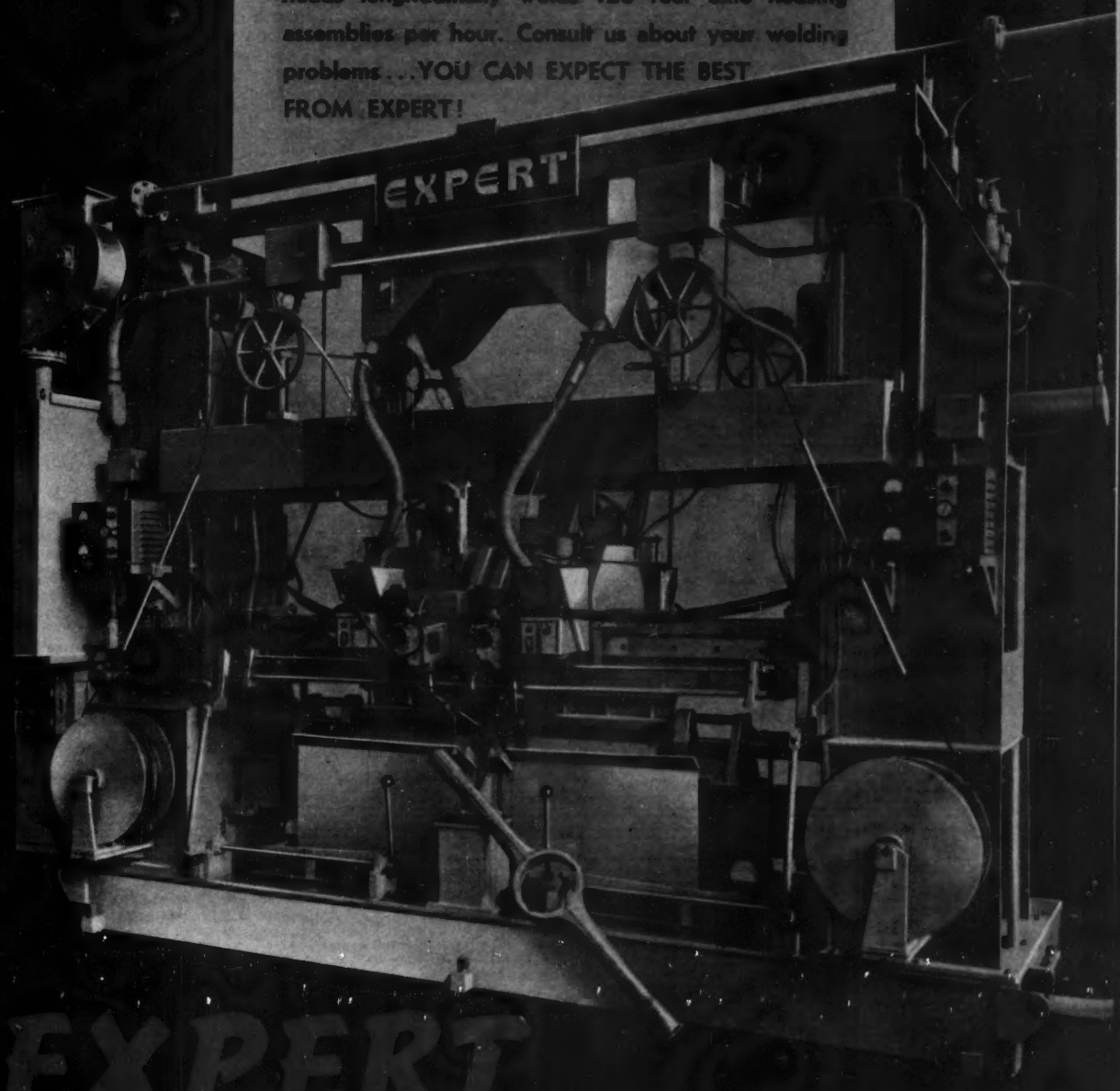
For controlled welding, this Automatic Submerged Arc Welder with four welding heads longitudinally welds 120 rear axle housing assemblies per hour. Consult us about your welding problems . . . YOU CAN EXPECT THE BEST FROM EXPERT!



EXPERT

WELDING MACHINE COMPANY

17144 Mt. Elliott Detroit 12, Michigan

Obituaries

George H. Fobian

George H. Fobian, president of the Oilgear Co., Milwaukee, Wis., died on November 4 at the age of fifty-seven years. Mr. Fobian was born in Milwaukee and spent his entire life in that city. His early business and technical education was applied extensively in the fields

George H. Fobian

of structural and mechanical engineering. In 1923, he joined the Oilgear Co. as an engineer. While in the engineering department he contributed to the design of the first self-contained, high-speed hydraulic press for straightening malleable castings, and later he assisted in developing a hydraulic feed controller. Mr. Fobian became assistant sales manager in 1926, and two years later, sales manager. In 1939, he was made vice-president of the company, and five years later, a director. Since 1945 Mr. Fobian had been president. He was a joint inventor of fluid drives for planers, hydraulic systems on presses, variable delivery pumps and controls, automatic hydraulic lathes, and hydraulic variable-speed transmissions. Mr. Fobian was a member of a number of technical organizations, including the Army Ordnance Association, the National Metal Trades Association, and the National Machine Tool Builders' Association.

KENDALL B. ROWELL, chief engineer of the American Locomotive Co., Schenectady, N. Y., died in Schenectady on December 12 at the age of fifty-two years. Mr. Rowell had been associated in the engineering department of the company since 1940. Last March he was named executive engineer for the company, and in November, chief engineer. Mr. Rowell is survived by his wife.

CLIFTON G. BIGWOOD, vice-president in charge of operations and a director of the L. S. Starrett Co., Athol, Mass., died suddenly on December 8. Mr. Bigwood had been with the company for thirty-six years, starting in the tool-room in 1916 and holding the successive positions of methods engineer, assistant superintendent and assistant vice-president. Recently he was elected to the position of vice-president in charge of operations. Mr. Bigwood was a member of the American Society of Tool Engineers, and was well known throughout the industry.

RAYMOND W. VONASCH, manager of federal and marine sales for the Ward Leonard Electric Co., Mount Vernon, N. Y., died suddenly on December 2 at the age forty years. Mr. Vonasch had been associated with the company since 1936, at first as a sales engineer, then as manager of the Newark, N. J. office. In 1949, he was appointed to the position of manager of the federal and marine department.

* * *

Use of Titanium in Jet Engines Increasing

Titanium now seems assured of a definite place in jet-engine manufacture. Three advantages of the application of the metal in this field are as follows: it weighs only two-thirds as much as ferritic materials, but is equally strong; it retains its strength up to about 800 degrees F., which is far above the limiting temperatures for aluminum; and it is almost completely unaffected by salt air and water.

Even after the knotty problems of extracting the metal from its ores were solved, problems in machining titanium threatened to discourage its use. Titanium cannot be cut by ordinary techniques—it smears on the tool. Jet-engine metallurgists found that the answer partially lay in machining the material at a low temperature, created by bathing the tool and the work in a stream of evaporating carbon dioxide (—112 degrees F.).

The techniques of using titanium alloy for jet compressor discs have, in the main, been ironed out, and engineers are now working to reduce the cost, which is still high. Development work to use titanium for compressor blades is also well under way. It appears that the pure metal, rather than an alloy, is preferable for blades.

Coming Events

JANUARY 19-22 — PLANT MAINTENANCE CONFERENCE AND SHOW at the Public Auditorium, Cleveland, Ohio. For further information, address Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

MARCH 23-27 — Eighth Western Metal Congress and Exposition sponsored by the AMERICAN SOCIETY FOR METALS, to be held in the Pan-Pacific Auditorium, Los Angeles, Calif. Secretary, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

MARCH 31-APRIL 2 — First International Magnesium Exposition of the MAGNESIUM ASSOCIATION, at the Washington National Guard Armory, Washington, D. C. Further information can be obtained by addressing the Association at 122 E. 42nd St., New York 17, N. Y.

APRIL 27-MAY 8 — BRITISH INDUSTRIES FAIR at Earls Court and Olympia, London, and Castle Bromwich, Birmingham, England. For further information, contact British Information Services, 30 Rockefeller Plaza, New York 20, N. Y.

MAY 18-22—FIFTH NATIONAL MATERIALS HANDLING EXPOSITION sponsored by the Materials Handling Institute, to be held at Convention Hall, Philadelphia, Pa. For further information, write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

JUNE 16-19—National Spring Technical Meeting and Welding and Allied Industry Exposition of the AMERICAN WELDING SOCIETY at the Shamrock Hotel, Houston, Tex. Executive secretary, J. G. Magrath, 33 W. 39th St., New York 18, N. Y.

* * *

Air Reduction Co. Opens Union, N. J., Plant

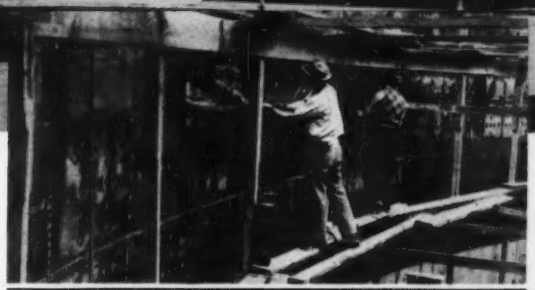
Oxy-acetylene welding and cutting apparatus and supplies now are developed, manufactured, and assembled in the large new plant of the Airco Equipment Mfg. Division of the Air Reduction Co., Inc. The new facility, on a 25-acre site in Union, N. J., replaces a multiple-story building in Jersey City, N. J. Of the 270,000 square feet of floor space in the modern brick and steel structure, all but the 18,000 square feet occupied by offices are on a single floor. Over 12,000 different items are made by the 1000 workers already employed, including welding and cutting torches, tips, regulators, gas-arc welding apparatus, and oxy-acetylene cutting machines.

COPPER

can insulate as well as conduct!

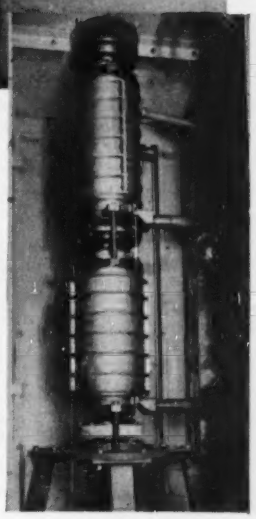
Aviation Medical Acceleration Laboratory, U. S. Naval Air Development Center, Johnsville, Pa.

The fact that copper has the highest electrical conductivity of all the commercial metals not only makes it the preferred metal for carrying current, but also results in its adoption for shielding. Electrical and electro-magnetic disturbances, currents and fields cannot pass through a grounded shield of copper sheet. In this sense, then, copper becomes an insulator. It is widely used for this purpose in laboratories, to assure the accuracy of delicate instruments. A recent spectacular example of such an application is in the Aviation Medical Acceleration Laboratory of the U. S. Naval Air Development Center, Johnsville, Pa. The purpose of the Centrifuge is to test the tolerances of men and animals to the types of acceleration and deceleration produced in military aircraft and to study the physiological conditions which set limits to such tolerances. Recording instruments attached to the subjects are extremely sensitive, but thorough shielding by sheet copper makes it possible to record brain waves without amplification . . . Revere will gladly collaborate with you on scientific and industrial applications of copper and its alloys, and aluminum alloys. See the nearest Revere Sales Office.



Revere Sheet Copper shielding being installed on wall of the Centrifuge chamber by The Howard P. Foley Co., Electrical Contractor, 1630 Pine St., Philadelphia 3, Pa.

A view of the human centrifuge itself. This can produce positive, negative or transverse "G", through accelerations up to 40 times the force of gravity. A great many records are made of each test, including X-ray motion pictures. The subject is observed continually by television.



Upper slip-ring stack—physiological, signal and power. Here copper serves as a conductor.

Official Photographs from U. S. Navy

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New Books and Publications

ADVANCED MECHANICS OF MATERIALS. By Fred B. Seely and James O. Smith. 680 pages, 6 by 9 1/4 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $8.50.

The topics considered in this book lie just beyond those usually included in a first course in strength of materials as given in most engineering schools in the United States. Although methods of analysis are given careful attention throughout the book, equal emphasis is given to the engineering evaluation and interpretation of the analyses as influenced by the assumptions made and principles used.

This is the second edition of a book published twenty years ago, and the original four parts (Preliminary Considerations; Special Topics on the Strength and Stiffness of Members Subjected to Static Loads; Localized Stress — Stress Concentration; and Energy Methods) have been greatly expanded. In addition, two new parts have been added: Influence of Small Inelastic Strains on the Load-Carrying Capacity of Members, and Introduction to Instability — Buckling Loads. Three appendixes, which should serve a useful purpose, are as follows: A Brief Introduction to the Mathematical Theory of Elasticity, The Elastic-Membrane (Soap-film) Analogy for Torsion, and Properties of an Area.

Any part of the book after the preliminary considerations is essentially independent of other parts, so the book can readily be made to fit courses of different lengths and also of different content and objectives.

STANDARDS FOR TRAINING MACHINE TOOL DRAFTSMEN. 11 pages, 8 1/2 by 11 inches. Published by the National Machine Tool Builders' Association, 10525 Carnegie Ave., Cleveland 6, Ohio. Price (paper-bound), $1.50.

This report, presented as a supplement to the Association's report, "Apprentice Training Standards for Machinists," includes a summary of standards for training machine tool draftsmen, and suggested forms of application, apprenticeship agreement, conditions of apprenticeship, and for a quarterly report.

WELDING PROCESSES AND PROCEDURES EMPLOYED IN JOINING STAINLESS STEELS. By Helmut Thielsch. 48 pages, 8 1/4 by 11 1/4 inches. Published by the Welding Research Council, 29 W. 39th St., New York 18, N. Y. Price (paper-bound), $2.

This report, Bulletin No. 14, contains a review of published, and the latest unpublished, information on metal-arc welding, carbon-arc welding, gas welding, resistance welding, and flame cutting of stainless steels. The welding characteristics, advantages, and limitations of the various processes, as well as the recommended procedures, are discussed in detail. (Individual copies may be purchased from the American Welding Society, also of the above address; bulk lots of ten or more from the Council.)

FBI REGISTER OF BRITISH MANUFACTURERS (1952-1953). 922 pages, 7 1/2 by 9 1/2 inches. Published for the Federation of British Industries by Kelly's Directories, Ltd., and Iliffe & Sons, Ltd., Dorset House, Stamford St., London, S.E. 1, England. Price, 42 shillings.

This, the only authorized directory of the Federation of British Industries, is a standard export reference book to British Industry. It comprises seven sections, including a classified buyers' guide listing over 6000 member firms arranged under more than 5000 alphabetical industrial headings. The introductory information is translated into French and Spanish. The Register provides a substantial cross-section of the most important producers of British goods over a very wide range of ind stry.

STANDARD METAL DIRECTORY (1952). 927 pages, 6 by 9 inches. Published by the Atlas Publishing Co., Inc., 425 W. 25th St., New York 1, N. Y. Price, $15.

The thirteenth edition of this Directory contains more than 10,000 detailed reports on steel mills, foundries, smelters, rolling mills, and nonferrous metal plants located in the United States and Canada. The plants are listed geographically and alphabetically, and give the name of the company, its capitalization, plant equipment, products manufactured, primary and secondary raw materials consumed, and names of company officials. Special lists are included, such as lists of dealers in used pipe and rails, scrap iron and scrap metal dealers, importers and exporters of scrap metal, operators of hydraulic presses, and dealers in used structural steel.

METAL FINISHING GUIDEBOOK-DIRECTORY (1953). 556 pages, 5 1/4 by 7 3/4 inches. Published by Finishing Publications, Inc., 381 Broadway, Westwood, N. J. Price (paper-bound), $3.

The twenty-first edition of this reference manual covers all operations of metal finishing compiled by well known authorities. The result is that the manual contains a vast amount of information on electroplating, cleaning, polishing, buffing, and related subjects. The engineering section is divided into the following headings: Finishing Plant Engineering; Mechanical Surface Preparation; Chemical Surface Preparation; Plating Solutions and Operating Data; Special Plating Procedures; Special Surface Treatments; Control, Analysis, and Testing; and Tables and Data Sheets. The directory section tells where the various materials and equipment required can be purchased.

CONTROL OF ELECTRIC MOTORS. Third Edition. By Paisley B. Harwood. 538 pages, 6 by 9 1/4 inches; 239 illustrations and diagrams. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $7.50.

This book contains up-to-date information on circuits, devices, and calculations used for the regulation of voltage, speed, tension, etc.; numerous industrial applications; descriptions of electronic amplifiers, rotating regulators, and positioning servomechanisms; and basic principles in regulating problems. Included are 350 problems, plus factual data upon which hundreds of additional problems can be based. Three areas of study have been observed: a general discussion of wiring diagrams, construction details, and pilot devices as applied to all kinds of motor control; a section on direct-current motors and motor control; and another on alternating-current motors and motor control.

* * *

Link-Belt Co. Opens Colmar, Pa., Plant

Newest link in the Link-Belt chain of manufacturing plants is in Colmar, Pa. Here, the seventeenth plant of this company has been completed expressly for the manufacture of custom designed conveying and processing machinery. The floor space of 300,000 square feet at the the site provides complete engineering and manufacturing facilities.

More than one hundred designers, engineers, and draftsmen are already at work on plans and drawings for equipment which will soon take shape in the shop. One of the first projects on the drawing boards at Colmar is a complete system to be installed in Venezuela for handling iron ore from a huge mine. The equipment will unload railroad cars from the mine at a rate of 6000 long tons of ore per hour. The same system will crush, screen, and store the ore, and finally transport it to the docks for shipment to the United States.

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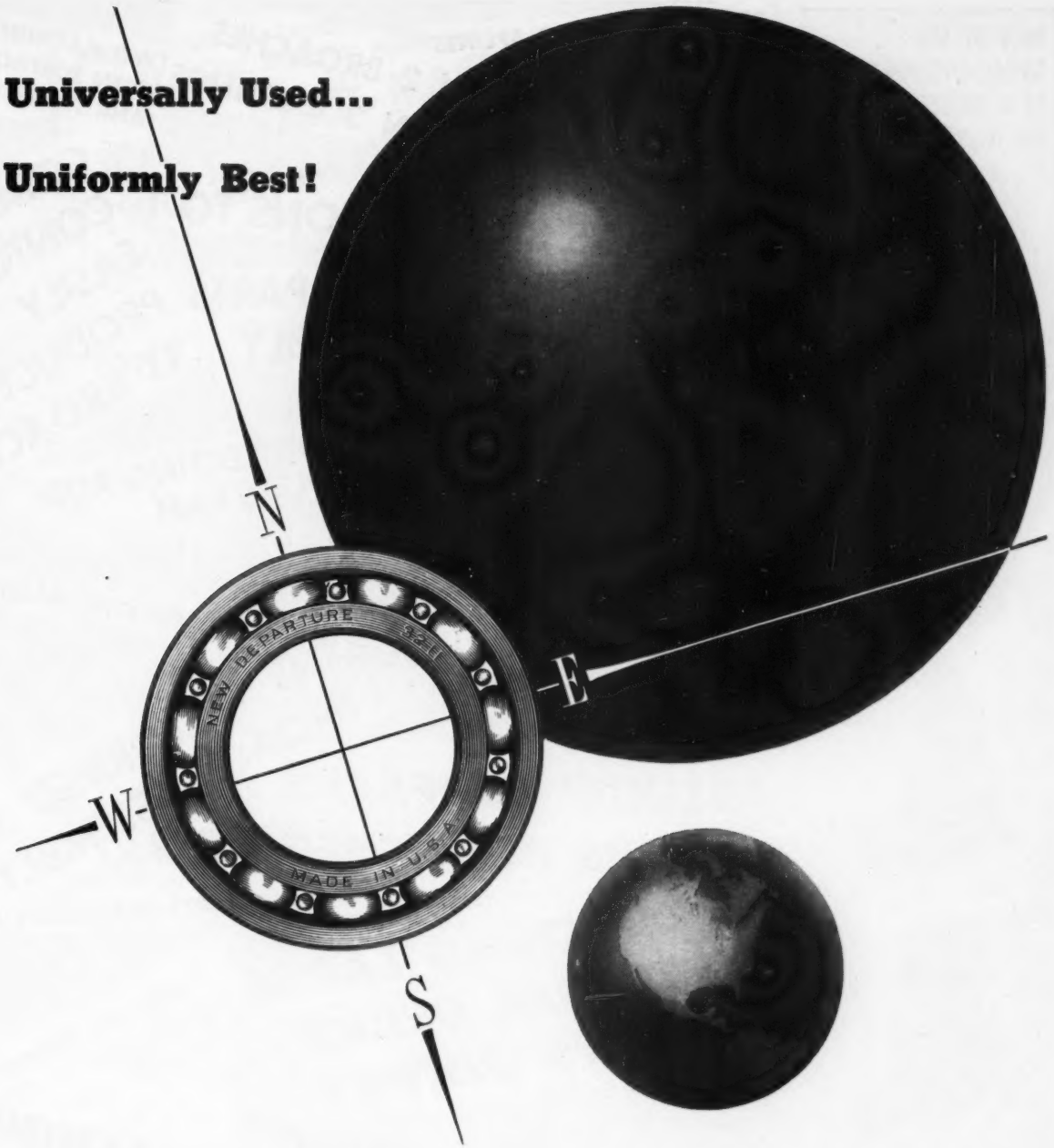
Uniformly Best!



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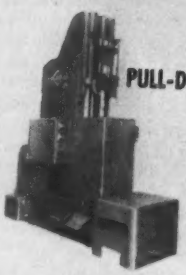
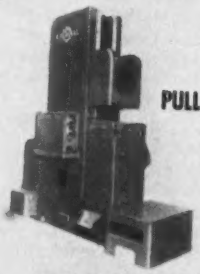


PULL-DOWN



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PRODUCING 13600 SPLINES PER HOUR

1 MACHINE WITH 2 BROACHES FINISHES 7 FACES ON 3 CASTINGS

TWO MACHINES BROA SEVEN SURFACES ON TANK TRACK PART

CUTS 3 OPERATIONS TO 1

COMPLEX CONTOURS EASILY PRODUCED BY BROACHING

BROACHING PARTS AFTER ASSEMBLY

COMPLETELY MACHINES CONNECTING ROD BIG ENDS ON ONE DUAL RAM

CUT COSTS 57%

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MAKE ONE BROACHING MACHINE DO THE WORK OF 3, 6 OR MORE MILLING MACHINES
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BROACHING SPLINES IN A BLIND HOLE
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FOUR SURFACE
SIMULTANEOUSLY
OOL ROOM PRECISION
12 SURFACES, 8 BORES, FINISHED IN ONE SETUP EACH OF 2 BROACHING MACHINES
QUICKEST WAY TO PRODUCE LARGE TAPERED SPLINES
ARE YOU GETTING THE MOST OUT OF BROACHING?
Shown here are random headlines out of recent issues of "BROACHING NEWS"*, published by Colonial in the interest of helping industry cut costs.
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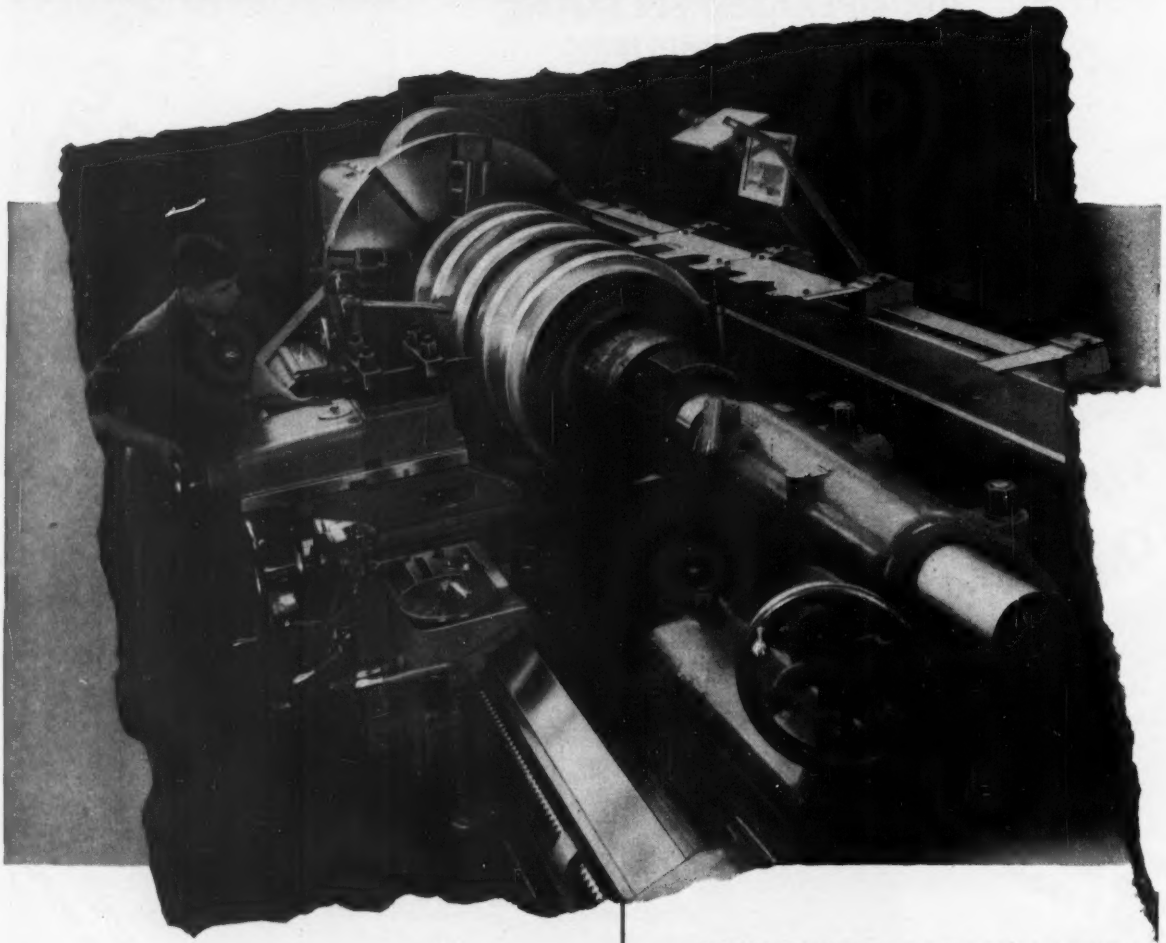
AUTOMATIC FIXTURE ON HORIZONTAL TRIPLE-SLOTS CLUTCH HUBS
TYPEWRITER CARRIAGES ARE BROACHED TOO
uses ONE Broaching Machine to broach 59 parts

Coming Soon...

A DEMONSTRATION: LEBLOND



Two-directional hydraulic tracing uses simple template.

Tracing stylus controls cross and length feed, powered by hydraulic motors.

All controls at apron; speed and feed can be varied during cut without interrupting the finish.

Fast roughing by means of length feed only—template serves as length stop.

Mechanical power rapid traverse to carriage and cross slide in both directions built into apron. Also, hydraulic rapid traverse for retracting cross slide when under tracer control.

Standard feeds and threads available through quick change box—hydraulic motors disconnected through fool-proof interlock.

USERS REPORT SAVINGS OF MORE THAN 75%.

CONDENSED SPECIFICATIONS

Lathe size	32"	40"	50"
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Constant hp DC motor, 2 to 1 speed change	30 hp	40 or 50 hp	
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Speed range, variable, rpm	2.5-230	1-165	1-165
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Single speed AC drive also available.

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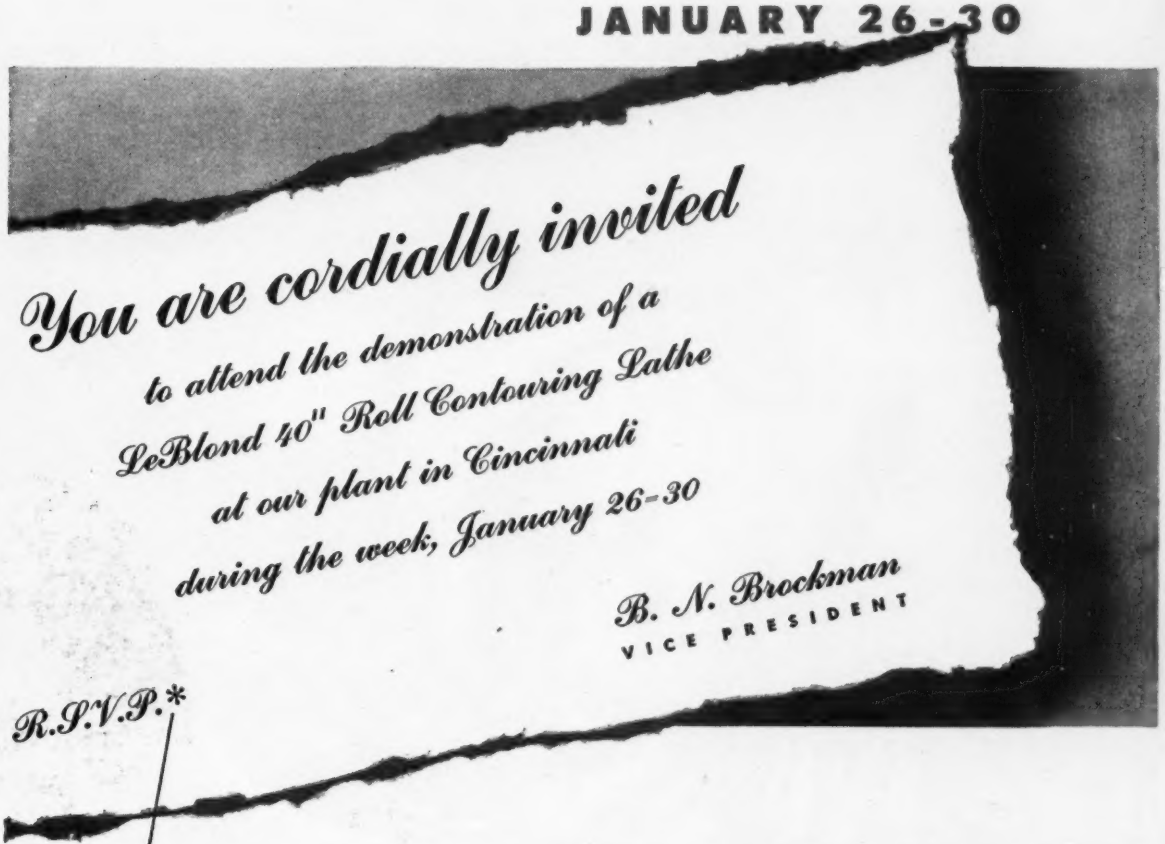
ROLL-CONTOURING LATHE

See it in operation at the LeBlond Plant

JANUARY 26-30



THE R. K. LEBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO

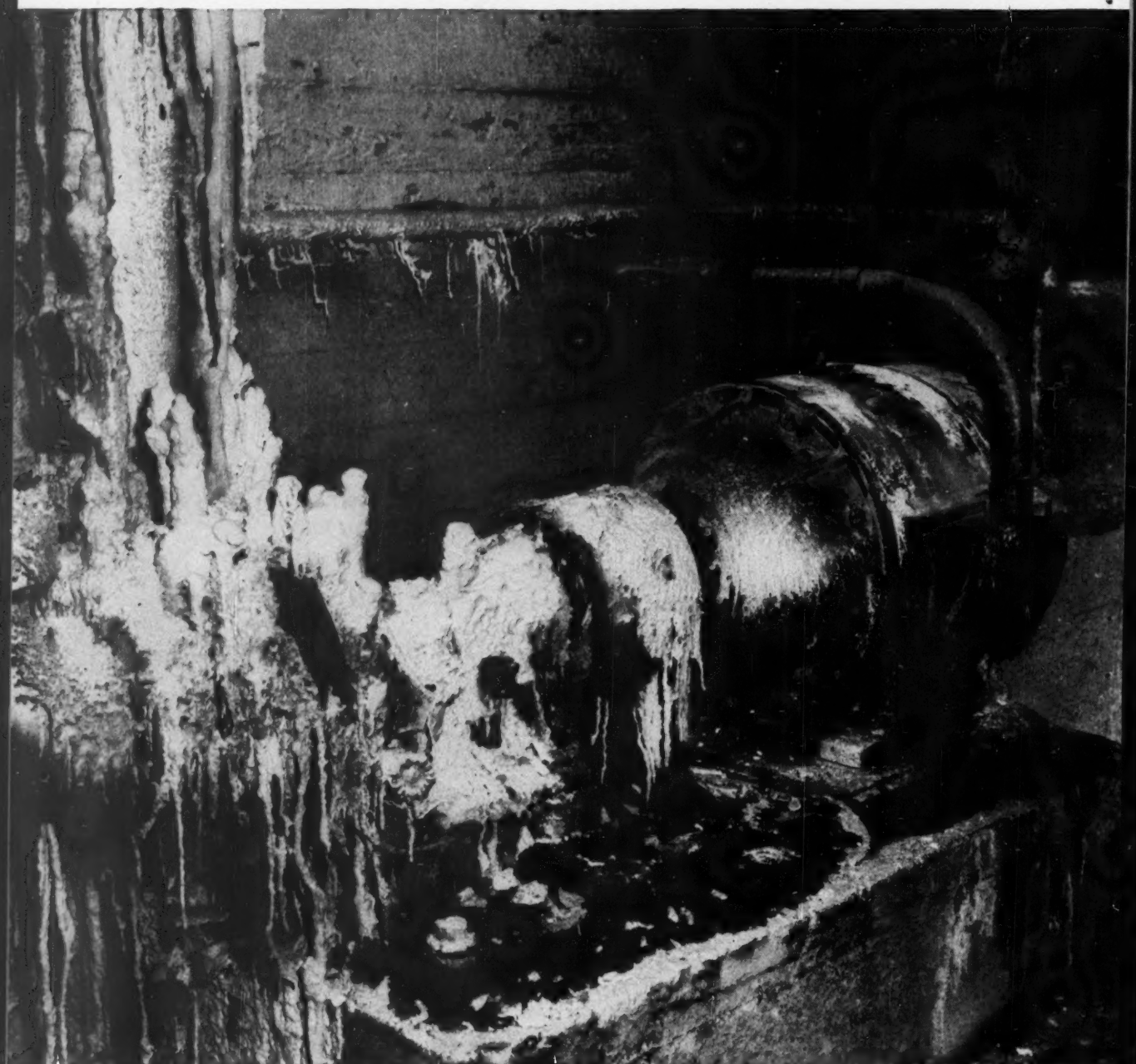
* Please tell us which day you'd like to come. We'll confirm.

turned faster by

LeBLOND *of Cincinnati*

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • *FOR MORE THAN 65 YEARS*

WHEN JOBS ARE TOUGH



CORROSIVE ATMOSPHERE doesn't bother this standard, "off-the-shelf" Tri-Clad motor. Totally enclosed, fan cooled, it runs 12 hours a day, six days a week, driving a flash cooler pump under tough conditions in a chemical plant.

GENERAL ELECTRIC

INDUSTRY DEPENDS ON G-E TRI-CLAD MOTORS

REG. U.S. PAT. OFF.

Here are three typical tough jobs being done safely, economically, and without interruption, by G-E Tri-Clad motors. They help show why more than 10,000,000 horsepower of G-E Tri-Clad motors are serving American industry today.

WIDEST VARIETY

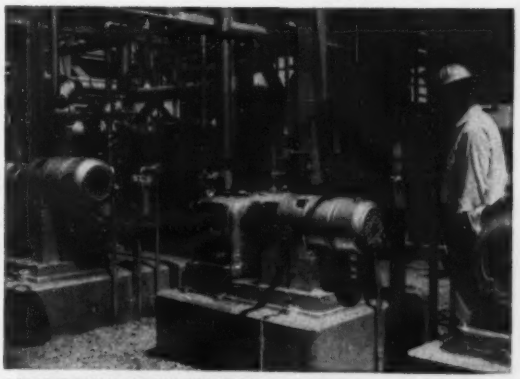
With the widest selection of standard motors obtainable anywhere, the Tri-Clad motor line offers ratings up to 2000 hp; all types of enclosures; gear motors, brake motors, and adjustable-speed drives—plus many other mechanical and electrical modifications to meet your requirements.

TRIPLE PROTECTION

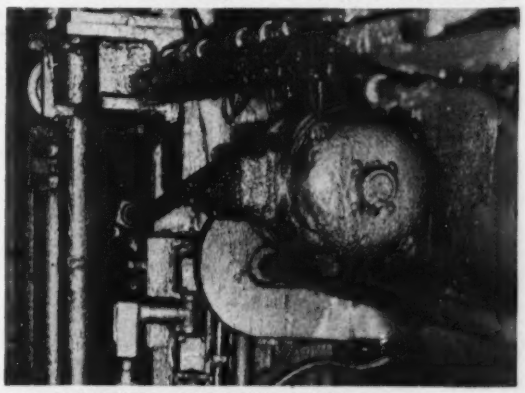
You get triple protection with *every* Tri-Clad motor—against physical damage, electrical breakdown, and operating wear and tear. Completely enclosed bearings last longer because they can be relubricated if necessary—and *without shutdown!* For specific product information, use the coupon below, or contact your nearby G-E Apparatus Sales Office, authorized G-E Agent or Distributor.

IMMEDIATE DELIVERY

Most standard G-E Tri-Clad motors are available immediately from stock. And the most complete sales and service network in the motor industry assures you prompt service by trained specialist and application engineers, for all your motor problems. General Electric Co., Schenectady 5, New York. 752-16



EXPLOSIVE ATMOSPHERE dangers are avoided by using standard explosion-proof Tri-Clad motors, such as these gearmotors driving water and hydrocarbon pumps in an oil refinery.



OIL, MOISTURE, ABRASIVE DUST can't stop this totally-enclosed Tri-Clad motor, operating below the strip in a cold strip steel mill. Motor is completely protected inside and out.

PROGRESSIVE MECHANIZATION...

a new G-E MORE POWER TO AMERICA program—motion picture and manual—case histories of the latest mechanization trends.

Send for literature.

Section U752-16
General Electric Co., Schenectady 5, N. Y.

Please send me the following on Progressive Mechanization:

☐ Free copy of the Progressive Mechanization Manual (GEA-5789)

Please send the following product bulletins:

☐ GEA-3580 (Open Drippproof Motors)

☐ GEA-4400 (Totally Enclosed Motors)

Name.....

Firm.....

Address.....

City.....Zone.....State.....

How do you select A PORTABLE POWER TOOL?

One tool engineer is influenced by light weight – another by high speed – a third by ease of handling – others by low power requirements or low maintenance.

Important as all these advantages are – the deciding factor should be the *work productivity* of the tool.

SUPER CYCLE ELECTRIC TOOLS have 10% to 20% greater productivity than any other type of portable tool. This can be demonstrated in your own shop, under your own operating conditions.

If you use, or can use, six or more portable tools in one location, we shall be glad to arrange for a demonstration of the advantages of SUPER CYCLE ELECTRIC TOOLS.

CHICAGO PNEUMATIC TOOL COMPANY

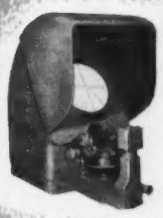
PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

Write for Catalog 905-2

11 MODELS

3 SCREEN SIZES

Pedestal Type
14" Diam. Screen



Bench Type
14" Diam. Screen
4 Models

Bench Type
5¾" x 7¾" Screen
3 Models

Unsurpassed Inspection Versatility

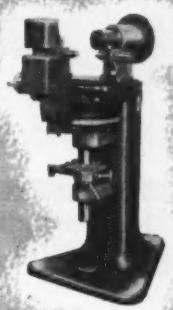
JONES & LAMSON OPTICAL COMPARATORS

The Essence of Quality Control

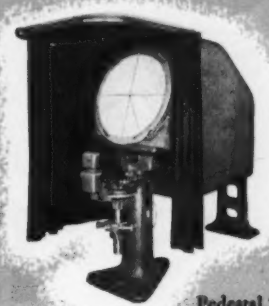
Jones & Lamson Optical Comparators are designed and built like rugged machine tools to withstand vibration and hard use. Yet they have the built-in accuracy to satisfy the most exacting laboratory standards.

- **They meet** the requirements of toolroom, laboratory and production inspection.
- **They precisely measure** height, depth, lead or spacing, as well as angles to degrees and minutes. They will measure to .0001".
- **They compare** intricately contoured parts with a master outline—and measure the amount of error.
- **They are convenient** to operate, easy to set up and read direct—*without computation.*
- **They operate** under normal lighting conditions. *No darkroom is needed.*
- **They will photograph** the enlarged shadow and record its relationship to a master chart.
- **Several persons** may study the shadow *at the same time.*
- **They will inspect** and measure surface contours, as well as profiles of objects such as type faces, stamping dies, punches, worn tools, etc.

Vertical Type
14" Diam. Screen



Direct
Projection
Type



Pedestal Type
30" Diam. Screen

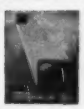
P.S. A complete line of STANDARD CHARTS and FIXTURES is maintained by us.

JONES & LAMSON

JONES & LAMSON MACHINE COMPANY
512 Clinton St., Springfield, Vt., U.S.A.

Machine Tool Craftsmen Since 1835

COMPARATOR DIV.
Dept. 710



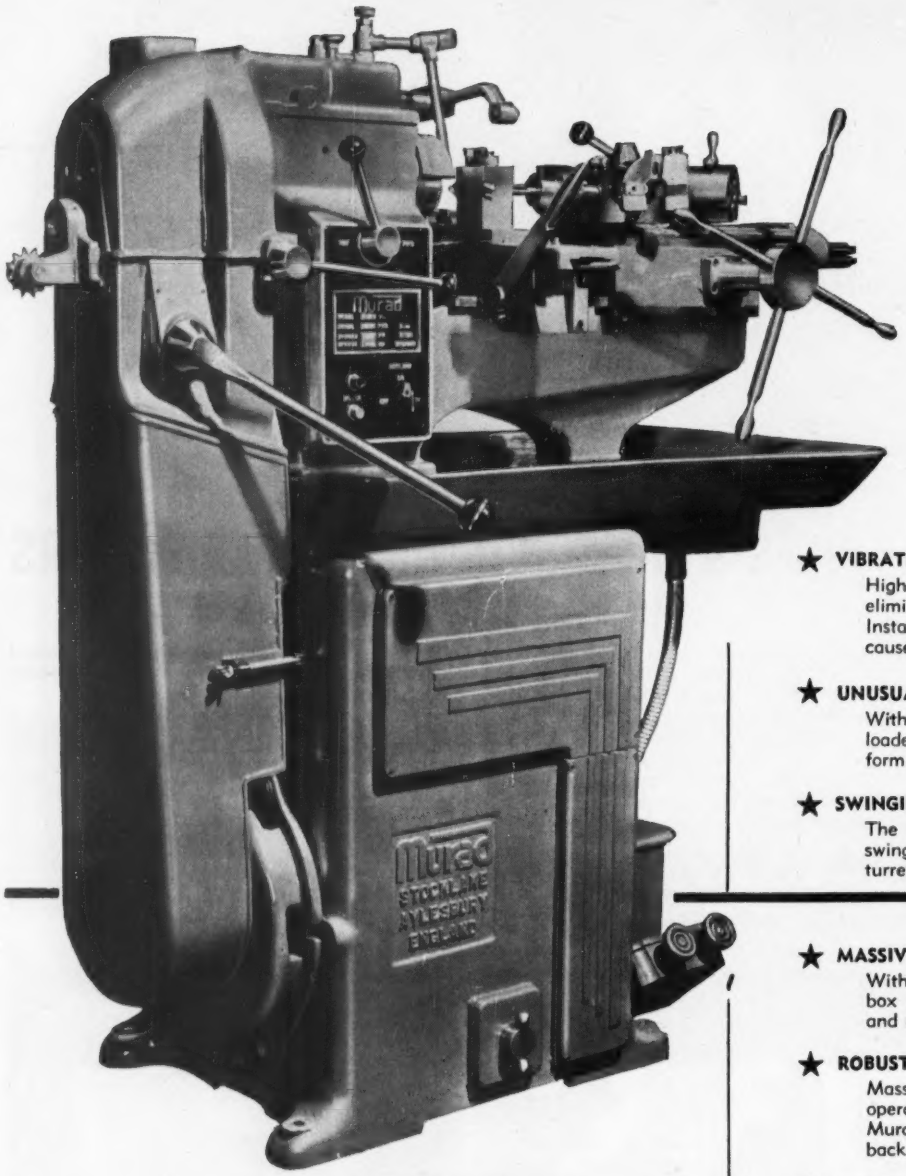
Jones & Lamson Machine Company
512 Clinton Street, Dept. 710
Springfield, Vermont, U. S. A.
Please send Comparator Catalog No. 402.

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____



Murad

ram type turret lathe

Designed and built for increased and improved production, the MURAD ram type turret lathe has a proven record which more than justifies all the claims put forward on its behalf. Special features of design make it unexcelled anywhere for production capacity, accuracy and operative convenience.

★ **VIBRATION-FREE DRIVE**
High spindle speeds with elimination of all vibration. Instant reversing possible because of cushioned drive.

★ **UNUSUALLY LARGE SPINDLE**
With its Hyper-Precision preloaded bearings allow wide form cuts.

★ **SWINGING STOP**
The only turret lathe with a swinging stop giving an extra turret tool position.

★ **MASSIVE BED**
With special positioning of box type ribs giving rigidity and maintained accuracy.

★ **ROBUST CROSS SLIDE**
Massive adjustable screw operated cross slide with Murad micrometer adjustable back tool slide.

★ **CONVENIENT CONTROLS**
Come easily to the hand at the natural height for fast and easy operation.

★ **SPEEDY FOOT CONTROL**
A choice of spindle speeds in the ratio of 1 to 4 instantly available by pedal control.

MURAD DEVELOPMENTS LIMITED, AYLESBURY, BUCKS, ENGLAND

You don't need to bolt machines down!

Put them on *Vibra-Mount*® Felt and *Save Your Floors!*

In most cases machines placed on Vibra-Mount Felt do not need to be bolted down. The strong Vibra-Mount adhesive between felt and floor and felt and machine holds firmly, preventing "walking." This method of mounting is simple, fast, and inexpensive. And there is a great big plus value in reduction of vibration, as much as 85%! Save your floors, lessen machine down-time, stop shaking employees and machines. When installing new machines or relocating your present equipment, use Vibra-Mount Felt. Simple details and further information will be found in the booklet "How to Reduce Vibration." Write for it on your company letterhead.

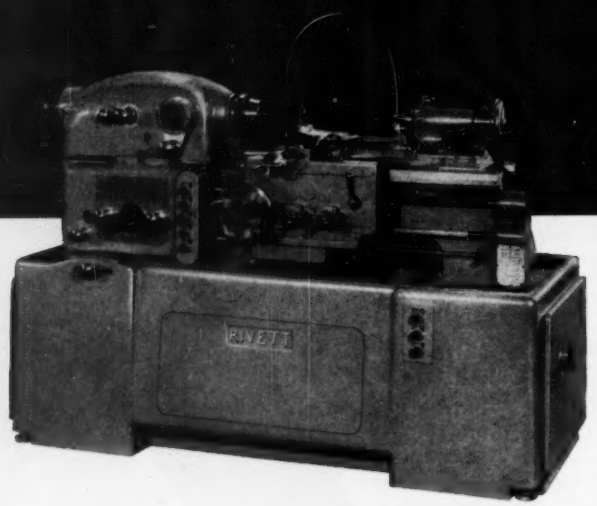
American Felt Company

TRADE MARK

GENERAL OFFICES:
68 GLENVILLE ROAD, GLENVILLE, CONN.

SALES OFFICES: New York, Boston, Chicago, Detroit, Cleveland, Rochester, Philadelphia, St. Louis, Atlanta, Dallas, San Francisco, Los Angeles, Portland, Seattle, San Diego, Montreal.—PLANTS: Glenville, Conn.; Franklin, Mass.; Newburgh, N. Y.; Detroit, Mich.; Westerly, R. I.—ENGINEERING AND RESEARCH LABORATORIES: Glenville, Conn.

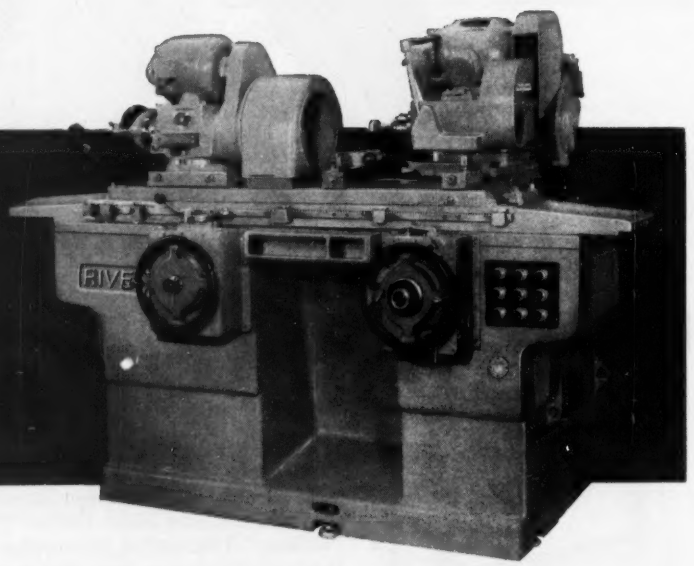
Why you gain more precision when you employ a RIVETT



2-1

Rivett 1020S is an Instrument Lathe and an Engine Lathe—a double-duty machine, combining the feather-touch sensitivity of an instrument lathe with that heavy-biting ruggedness which carbide cutting tools require. Qualifies for any turning within its 12½" swing and 20" centers.

QUICK-CHANGE ARTIST!



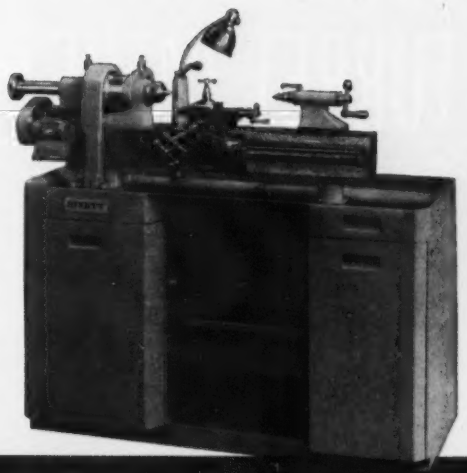
You can use other lathes . . . employ other types of metal-working machines . . . but on no other tool can you get so much production with such fine precision as on a Rivett!

GUARANTEE

Rivett Lathes and Grinders are made with such fine accuracy that it is possible to guarantee their performance to the most exacting limits. For example:

The Rivett 608 will turn or bore within 0.0001" in six inches work held in collet, and turn between centers within 0.0001" in six inches.

The Rivett 1020S will turn between centers within 0.0004" in twelve inches, and turn with work held in chuck within 0.0008" in twelve inches.



What does precision mean?

Rivett 84 is an accurate small hole grinder which converts quickly and easily for external grinding. Ideal for the diversified work in a toolroom and die shop. Hole and external to 3" dia. and to 4" length.

Rivett 918 "Steelway" Cabinet Lathe has the versatility to produce a toolroom part in a fraction of the time required to set up a larger, cumbersome machine. It is also furnished with turret and cross slide to produce duplicate parts with toolroom precision.

RIVETT LATHE & GRINDER, Inc.

Dept. MR-1, Brighton 35, Boston, Massachusetts

For More Precision Work RELY ON RIVETT LATHES AND GRINDERS, The Master Craftsman's Master Tools

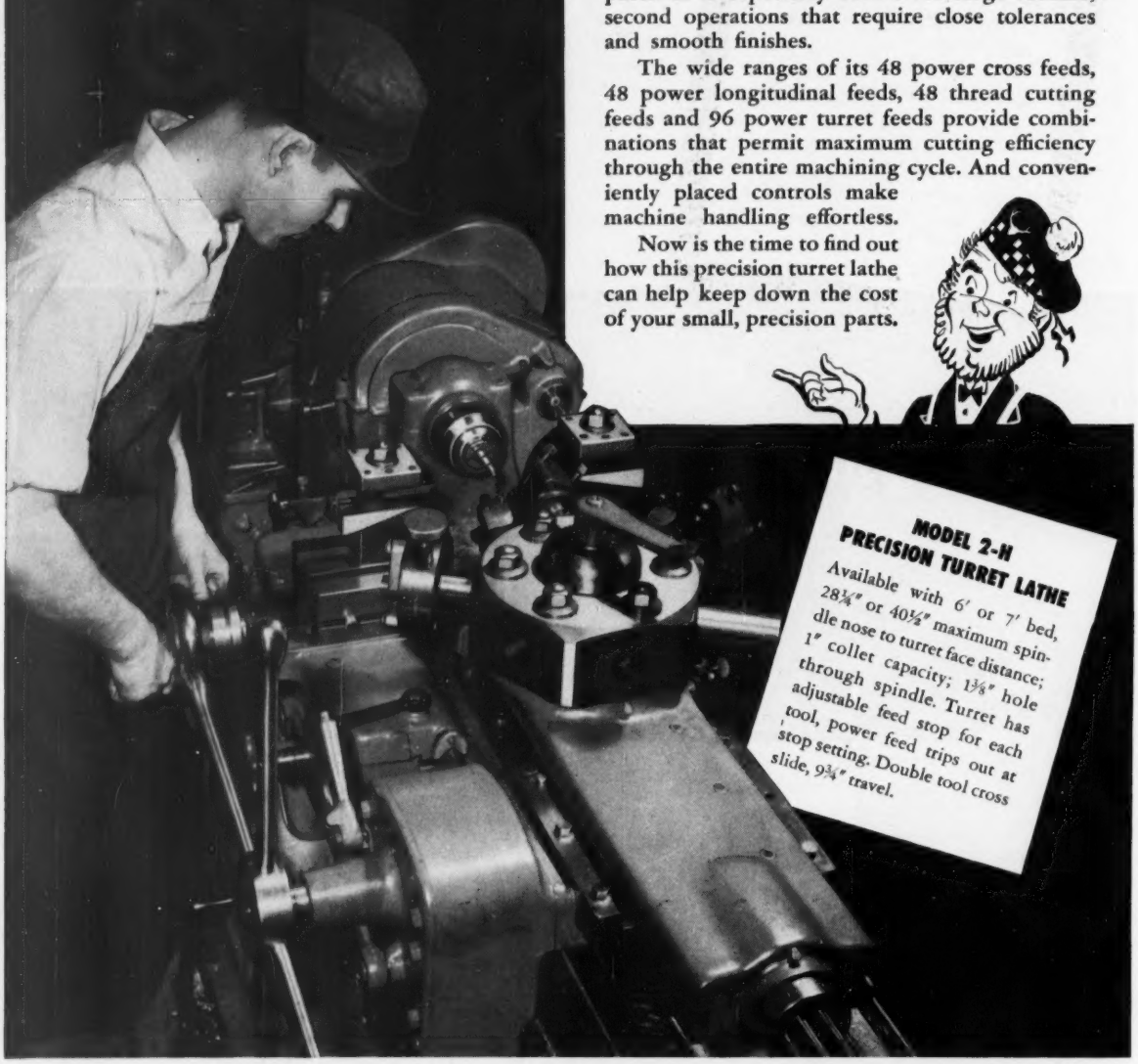
SOUTH BEND 2-H TURRET LATHE

Keeps Costs Down on Precision Parts

This precision-built turret lathe is designed specifically for the machining of accurate, duplicate parts. It is especially suited for large-volume, second operations that require close tolerances and smooth finishes.

The wide ranges of its 48 power cross feeds, 48 power longitudinal feeds, 48 thread cutting feeds and 96 power turret feeds provide combinations that permit maximum cutting efficiency through the entire machining cycle. And conveniently placed controls make machine handling effortless.

Now is the time to find out how this precision turret lathe can help keep down the cost of your small, precision parts.



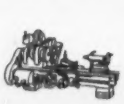
MODEL 2-H PRECISION TURRET LATHE

Available with 6′ or 7′ bed, 28¼″ or 40¼″ maximum spindle nose to turret face distance; 1″ collet capacity; 1⅜″ hole through spindle. Turret has adjustable feed stop for each tool, power feed trips out at stop setting. Double tool cross slide, 9¾″ travel.

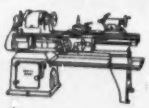
SEND INFORMATION CHECKED:

☐ _____

_____



☐ 9″ and 10″ BENCH LATHES



☐ 10″ to 16-24″ FLOOR LATHES

☐ ½″ and 1″ Collet TURRET LATHES

☐ 14″ DRILL PRESSES

☐ 7″ BENCH SHAPERS

Name _____ Company _____

Street _____ City & State _____

Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

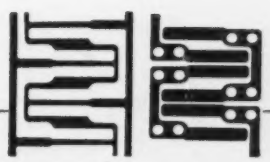
THE TREND IS TO MORE STAMPINGS WITH BLISS PRESSES

Bliss High Production Press, No. 630, one of six at Western Electric's Kearny Works.

At *Western Electric* Bliss Presses Produce Switchboard Stampings at 300 spm

For *really* high-volume production of precision stampings for telephone switchboards, Western Electric Company uses six Bliss High Production Presses at its Kearny (N. J.) Works. Equipped with precision roll feed and scrap shear, the Bliss units operate at speeds up to 300 spm and hold tolerances within .002" in progressive dies. And set-up time for die changeover in these Bliss automatic presses averages *only 30 minutes.*

Bliss High Production Presses are ideal for high-speed, short-stroke production and for progressive die work. This type of press was introduced by Bliss more than 20 years ago in keeping with its continuing policy of providing "the right press for a given job." Whether your job is stamping, drawing, forming or squeezing, it's wise to investigate Bliss *first.*



FOR EXAMPLE:

Hinge Spring (above)
.008" nickel silver; No. 630 Bliss press; progressive tool and automatic feed plus pilots; 125 spm; two parts per stroke, 9,000 parts per hour; 2,850,000 parts per year.

Contact Spring
.0225" nickel silver; No. 620 Bliss High Production Press; compound tool and automatic feed; 300 spm; 12,500 parts per hour; 1,200,000 parts per year.

Clamping Plate
.032" steel; No. 650 Bliss press; progressive tool and automatic feed plus pilots; 180 spm; five parts per stroke; 41,400 parts per hour and 5,700,000 parts per year.

Contact Spring
.0131" nickel silver; No. 630 Bliss press; compound tool and automatic feed; 300 spm; 13,500 parts per hour; 6,850,000 parts per year.

E. W. BLISS COMPANY, CANTON, OHIO
E. W. Bliss (England) Ltd., Derby, England
E. W. Bliss Company (Paris), St. Ouen sur Seine, France
PRESSES, ROLLING MILLS, SPECIAL MACHINERY

Branch offices in Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, Toledo; and Toronto, Canada. West Coast Representatives: Moore Machinery Co., Los Angeles and San Francisco; Star Machinery Company, Seattle. Other dealers in United States cities and throughout the world.

BLISS

ON YOUR PRESS IS MORE THAN A NAME...IT'S A GUARANTEE!

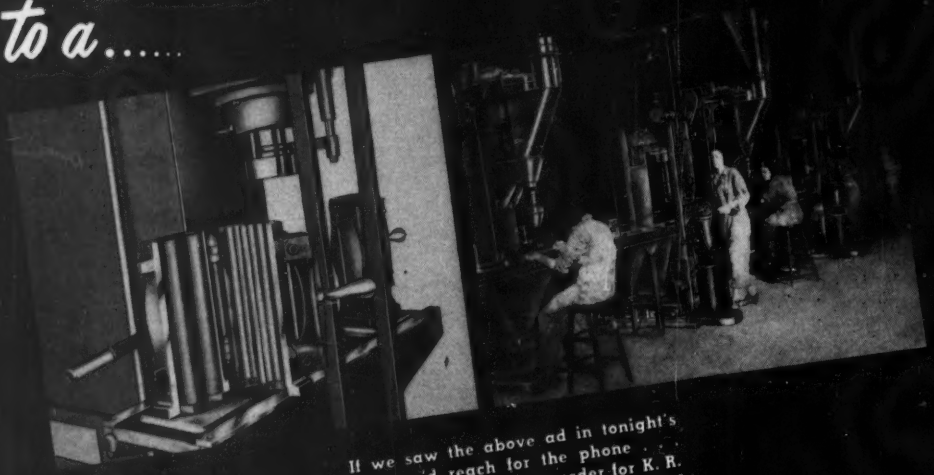
This ad....

Help Wanted

COMPANY to design and build shell loading hydraulic presses. Must be fast, efficient and engineered for safety. World War II experience preferred.

DESIGNE... tool designers, draftsmen, ...established manufactur...

FITS KRW
to a.....



If we saw the above ad in tonight's paper, we'd reach for the phone . . . quick! The job's made to order for K. R. Wilson. During World War II, KRW engineers designed a faster and safer method for loading shells and incendiary bombs. Hundreds of KRW 1-station, 2-station and 4-station shell loading presses were supplied to bomb loading contractors across the country. The photo at left above shows a close-up of the shell case holder on a KRW 4-station shell loader. At right is a battery of KRW presses working at top speed in one of the nation's largest arsenals.

K. R. Wilson is set to do an even bigger job today. Almost two million dollars in new machinery and equipment have been added to our plant since World War II. So if you have shell-loading contracts, write, wire or phone KRW for the right equipment. We can go to work on your order at a moment's notice.

Send for
FREE NEW BOOKLET
It tells all about our plant, equipment, facilities and experience in war and peacetime production. It's yours for the asking. Write Dept. 15.

K R WILSON
215 Main St. • Buffalo 3, N. Y.

"Freedom is Everybody's Business!"
WE WANT TO MAKE IT OUR BUSINESS!
K R WILSON

Product Directory

To find headings easily, look for capital letters at top of each page to denote locations.

ABRASIVE CLOTH, Paper and Belt
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVE DISCS
See Discs, Abrasive.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
American Steel Foundries, Elmes Engineering Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farquhar, A. B., Co., 21 Duke St., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York 1, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York 13, N. Y.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOYS, Aluminum
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.

ALLOYS, Magnesium
Dow Chemical Co., Midland, Mich.

ALLOYS, Non-Ferrous
American Brass Co., 25 Broadway, New York.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ARBOR PRESSES
See Presses, Arbor.

ARBORS AND MANDRELS
Beaver Tool & Engineering Corp. (Arbors, only), 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bunell Machine & Tool Co., 1600 East 24th St., Cleveland 14, Ohio.
Cleveland Twist Drill Co, 1242 E. 49th St., Cleveland, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Erickson Tools Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BABBITT
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.

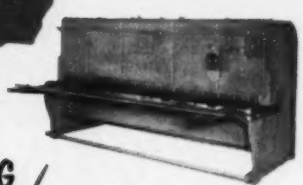
(Continued on page 282)

JOHNSON

EXTRA
SERVICE & SAFETY
at no higher cost!
Bonus Built
POWER PRESSES

Will give more service for your production dollar . . . Smaller presses will handle heavier jobs.

Write for complete specifications –

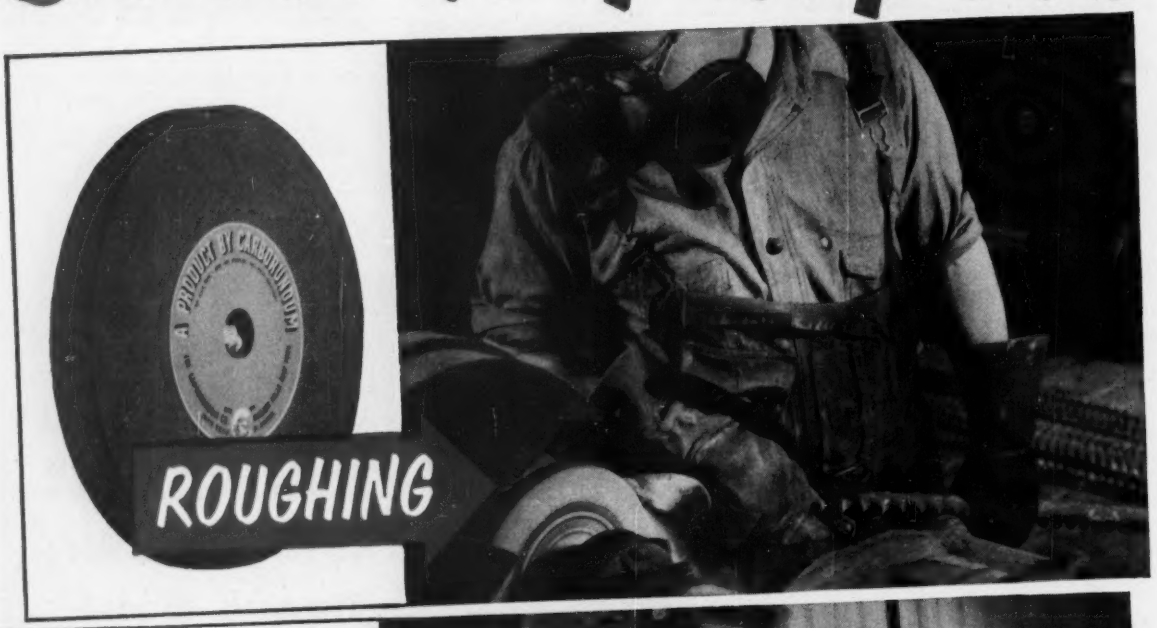


FOR SPEED, POWER AND ACCURACY IN HYDRAULIC SHEARING
Will increase your production to a new high. No gears or clutch, cannot be overloaded. Write to

the HYDRA-SHEAR
Will shear mild steel up to 10 gauge . . . less curl and burring . . . no gears or clutch

Johnson MACHINE and PRESS CORP.
620 WEST INDIANA AVE. • ELKHART, INDIANA

General Purpose



Only CARBO

TRADE

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Wheels . . .

General Purpose Wheels by CARBORUNDUM give you the widest possible range of abrasive tool versatility. Furnished in standard sizes for every known make of grinding machine, they improve the quality and quantity of work from veteran and inexperienced operators alike. In the cool cutting, long lasting V30 bond developed especially for general purpose work, "ALOXITE" aluminum oxide wheels are outstanding performers. They give you the ideal combination of abrasive grain, bond, grade and structure which provide highest grinding performance at lowest total cost.

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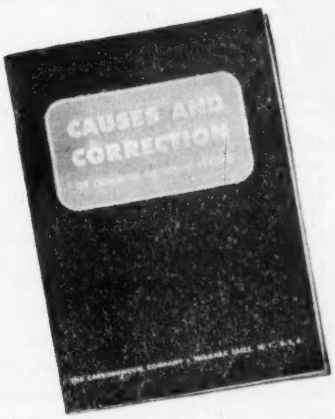

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THE CARBORUNDUM COMPANY, Dept. M 81-81
Niagara Falls, New York

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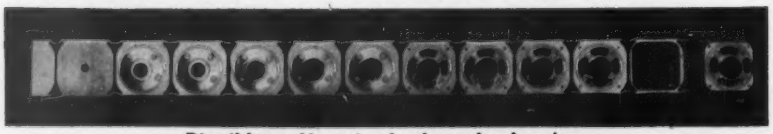
81-85

B. Jahn PROGRESSIVE DIES SAVE* AMERICAN INDUSTRIES Millions!

Thousands of unnecessary, costly operations have been eliminated from America's production lines by B. Jahn! Actual die strip photographs illustrate intricate — seemingly impossible tooling problems overcome by B. Jahn's versatility and ingenuity.

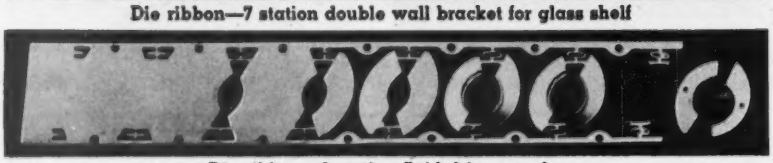
Production runs increase — set-up time is slashed — individual press operations are eliminated — better die products result — for every B. Jahn built die is PRODUCTION PROVED *to the customer's complete satisfaction.*

*B. Jahn Progressive dies not only SAVE millions, they MAKE millions!



Die ribbon—11 station loud speaker housing

Die ribbon—7 station double wall bracket for glass shelf



Die ribbon—6 station fluid drive coupler

By running from 10 to 50,000 parts or complete assemblies for customer's production line use *before the die is delivered,* error is eliminated! guesswork ended! chance abolished! The die is certified PRODUCTION PROVED!

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Read the many illustrated, money-making case histories! Find out how B. Jahn eliminates major tooling problems for engineers! See the many intricate die ribbons from B. Jahn Dies! Learn about the 165 skilled B. Jahn craftsmen and their ultra-modern facilities! Engineers, this is money-making *must* reading, send today!

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B. Jahn

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Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pope Machinery Corp., Haverhill, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

BALLS

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Kennametal, Inc., Latrobe, Pa.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.

BARS, Phosphor Bronze

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BARS, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York 13, N. Y.
LaSalle Steel Co., Hammond, Ind.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Republic Steel Corp., Union Drawn Steel Div., (Cold Drawn), Republic Bldg., Cleveland, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded

Bunell Machine & Tool Co., 1600 East 24th St., Cleveland 14, Ohio.
Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.

BEARINGS, Babbitt

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Ball

Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, Ill.
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Fafnir Bearing Co., New Britain, Conn.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., General Motors, Bristol, Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffmann Bearings Corp, Stamford, Conn.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Torrington Co., Torrington, Conn.

BEARINGS, Bronze and Special Alloy

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Lineshaft

Fafnir Bearing Co., New Britain, Conn.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Shafer Bearing Corp., Downers Grove, Ill.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, Needle

C & C Sales Corp., 1771 Broadway, New York 19, N. Y.

(Continued on page 284)

Practical Assistance

Whether it's a tight squeeze in a cookie jar or a bottleneck on your production line . . . practical assistance—the kind that solves the problem simply and fast—is your best answer.

And ***PRACTICAL TECHNICAL ASSISTANCE*** is a *Cities Service specialty*.

Cities Service Lubrication Engineers can offer *practical assistance* that will eliminate bottlenecks caused by faulty lubrication . . . will mean dollars, man-hours and equipment saved. They're specialists in the industry's most effective lubricating practices. In addition, they offer the most complete line of Cities Service quality lubricants.

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✔ Check on the high quality of all Cities Service lubricants. Ask critical users. Or better still, test them on the job.

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✔ And finally, discuss your problems with a Cities Service Lubrication Engineer . . . he's probably solved many like them for other machine operations. Write or phone CITIES SERVICE OIL COMPANY, Dept. A18, Sixty Wall Tower, New York City 5 . . . or get in touch with the office nearest you.

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DUMORE® tool post grinders

add productive capacity

to your present machine tools

A Dumore tool post grinder provided the only solution for this unusual problem. Mounted on a vertical boring mill, it halved former production time for grinding on the perforated, tapered surface of 43" cast iron strainer cores.

Put this Dumore grinder on a turret lathe, planer, milling machine, shaper, boring mill or universal grinder. In fact, mounted on any machine you'll get a more versatile tool that will not only machine the workpiece, but finish grind without changing setup — or switching job to another machine. What's more, it delivers precision work to .0001" accuracy.

Production men say the Dumore grinder is the busiest tool in the shop. They like its flexibility . . . the high quality work it turns out. These grinders are ideal, too, for tool room and maintenance work.

Dumore tool post grinders often pay for themselves on the first job. They offer an amazing potential for reducing labor and handling costs... increasing machine capacity . . . improving product quality.

Ask your industrial distributor to show you how Dumore tool post grinders can cut costs for you, or write

THE DUMORE COMPANY

1343 Seventeenth Street • Racine, Wisconsin

Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Orange Roller Bearing Co., Inc., Orange, N. J.
Torrington Co., Torrington, Conn.

BEARINGS, Roller

Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, Ill.
Ball & Roller Bearing Co., Danbury, Conn.
C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., Harrison, N. J.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Shafer Bearing Corp., Downers Grove, Ill.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Self-Lubricating (Oilless)

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
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C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Thrust

Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, Ill.
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Shafer Bearing Corp., Downers Grove, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BELT FASTENERS, Metal, Leather, Etc.

Bristol Co., Platts Mills, Waterbury, Conn.

BELT SHIFTERS

Standard Pressed Steel Co., Jenkintown, Pa.

BELTING TRANSMISSION

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Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

BENCHES, Work, and Bench Legs

Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, Angle Iron, Plate, Etc.

Consolidated Mch. Tool Corp., 565 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Kling Bros. Engineering Works, 1320 No. Kostner Ave., Chicago 51, Ill.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Struthers Wells Corp., Machinery Div., Titusville, Pa.

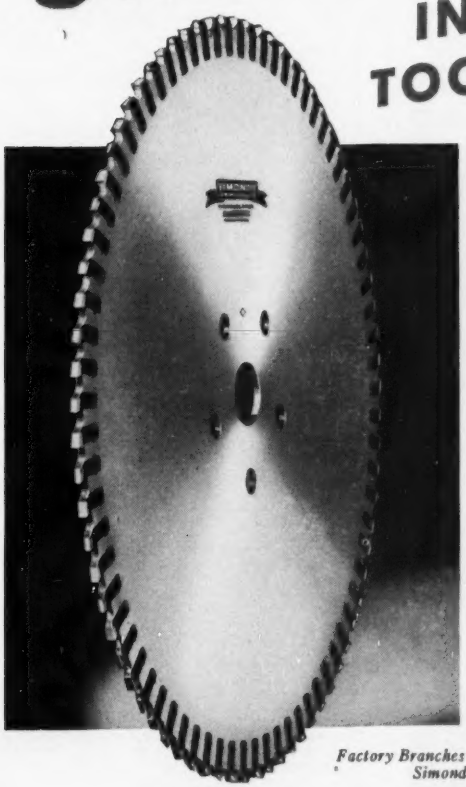
BENDING MACHINES, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., & Co., 21 Duke St., York, Pa.

(Continued on page 286)

A Wedge for every tooth means Added Strength for SIMONDS

INSERTED-TOOTH SAWS



Here's the most rugged design of all metal-cutting saws . . . the tough saw-plate of special Simonds Steel, fitted with alternating square and beveled inserted teeth . . . *and with a wedge for every tooth*, to give that extra strength for heavy cutting. In fact, this saw is practically indestructible, for it can be readily repaired if damaged and restored to original efficiency by an average mechanic.

Yet Simonds Inserted-Tooth Saws have the same quick clearance as other Simonds Saws . . . and the inserted teeth cut a "Tri-vided" chip that falls free in 3 pieces.

For general heavy-duty work, this is *Industry's No. 1 Saw.* And for other types of work, Simonds also makes Circular Metal Saws in Segmental, Solid-Tooth and Carbide-Tipped types. So ask your Industrial Supply Distributor to secure for you the *unbiased* consulting of a Simonds Saw Engineer.

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SAW AND STEEL CO.
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Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon. Canadian Factory in Montreal, Que. Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Simonds Abrasive Co., Phila., Pa. and Arvida, Que., Canada

Vinco is mass producing component parts for him

His full enjoyment of dinner at home is never spoiled by worries about component parts when Vinco is producing them. He knows the parts will be delivered as promised and will meet all specifications. This confidence is reflected by manufacturers throughout the metal working industry. As a result, Vinco has been forced to expand its production facilities. The next time you have parts to be machined to loose or close tolerances, call Vinco.

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Formed Wheel Dressers, Automotive Cam Checkers, Optical Dividing Heads, Precisiondexes

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Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Struthers Wells Corp., Machinery Div., Titusville, Pa.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BENDING MACHINES, Pipe

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Farquhar, A. B., & Co., 21 Duke St., York, Pa.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BLAST CLEANING EQUIPMENT

Leiman Bros., Inc., 156 Christie St., Newark, N. J.
Pangborn Corp., Hagerstown, Md.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

BLOWERS

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Leiman Bros., Inc., 156 Christie St., Newark, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

BOILER TUBES

Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Steel and Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLTS AND NUTS

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Erie Bolt & Nut Co., Erie, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

BOLTS, T-Slot

Standard Shop Equipment Co., Inc., 8299 W. Tinicum Ave., Philadelphia, Pa.

BOOKS, Technical

Industrial Press, 148 Lafayette St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

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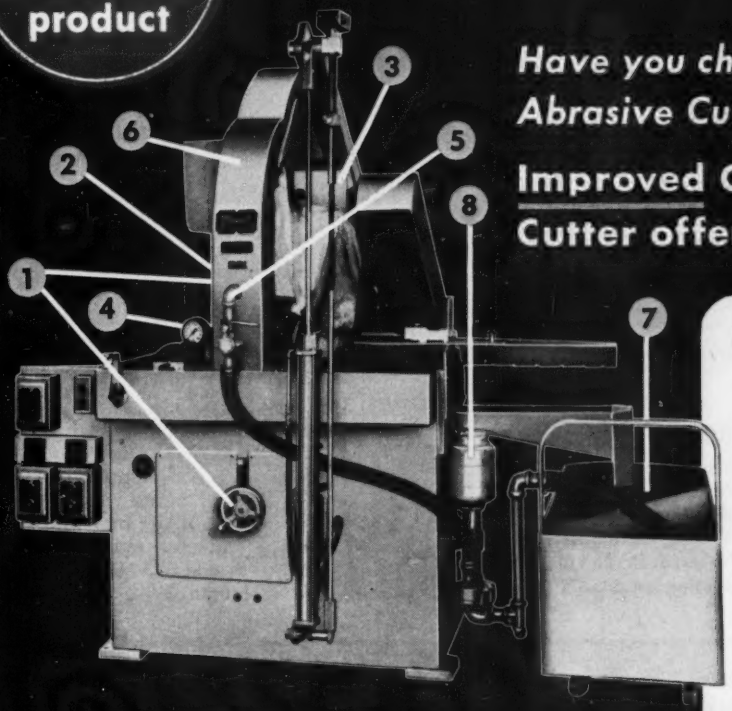
Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Canedy-Otto Div. Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Moline Tool Co., 102 20th St., Moline, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Wales-Strippit Corp., North Tonawanda, N. Y.

(Continued on page 290)

an **ACCO** product

CAMPBELL ABRASIVE CUTTERS



Have you checked on Abrasive Cutting lately?

Improved Campbell No. 406 Cutter offers these features:

1. **BRIDGE TYPE WORK CLAMP** on both sides of cutting wheel, quickly and easily adjusted
2. **WHEEL GUIDES** for more accurate cuts . . . reduces wheel flutter
3. **CUTTING WHEEL OSCILLATION** for quality cutting over 2" diameter solids
4. **LOW PRESSURE SELF-CONTAINED HYDRAULIC SYSTEM** for operating controls
5. **EASILY ADJUSTED, SIMPLIFIED, RUGGED COOLANT DISTRIBUTOR** to insure adequate supply of coolant on both sides of cutting wheel
6. **COMPLETELY ENCLOSED CUTTING WHEEL** for operator's safety
7. **SEPARATE COOLANT TANK** . . . large capacity . . . may be easily removed for cleaning
8. **EXTRA-LARGE CAPACITY COOLANT PUMP**

—plus many other valuable features!

CAMPBELLS *Save You Money*

• Even old model abrasive cutters made big savings by reducing the cut-off time per piece, but the new improved CAMPBELL Abrasive Cutters—with their many new time and effort reducing features—show still greater efficiency and savings. CAMPBELLS pay for themselves out of savings.

Check the methods and equipment you use. On many jobs cutting time can be reduced up to 75%. Machines can be furnished in fully automatic or semi-automatic types.

Write today for Bulletin **DH-260** which tells you how to modernize your cutting procedure with a CAMPBELL 406. Then give us details of the job to be done so we can make recommendations and quote prices.

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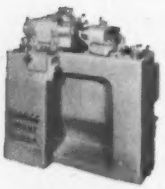
AMERICAN CHAIN & CABLE

925 Connecticut Ave., Bridgeport 2, Conn.

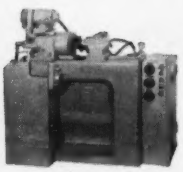
CAMPBELL
Abrasive Cutters and Nibblers

bryant
internal grinding



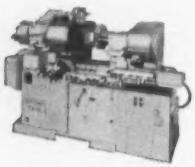
no. 1309-W

Finishes 2 bores and a taper straight and concentric. 2 wheelheads are used on this semi-automatic. Max. traverse stroke, 6". Max. grinding length, 3½".



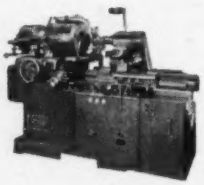
no. 1109

For high production of small bores where accuracy of size and finish are required. Max. traverse stroke, 6". Max. grinding length, 3½".



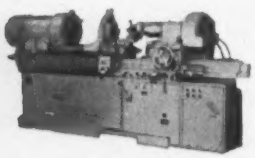
no. 1316

Two wheelheads for high production of jobs requiring face and bore, or face and O.D. grinding. Max. traverse stroke, 20". Max. grinding length, 8".



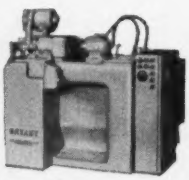
no. 1116

A general purpose hole grinder for tool room, small shop, or general production. Maximum traverse stroke, 20". Maximum grinding length, 8".



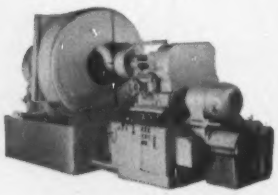
no. 1416

Specially designed for grinding bores in long work, such as machine tool spindles. Maximum traverse stroke, 20". Maximum grinding length, 8".



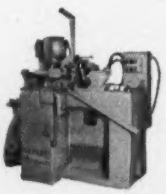
no. 1209

A fully automatic, high production machine for small and medium bore grinding. Max. traverse stroke, 6". Max. grinding length, 3".



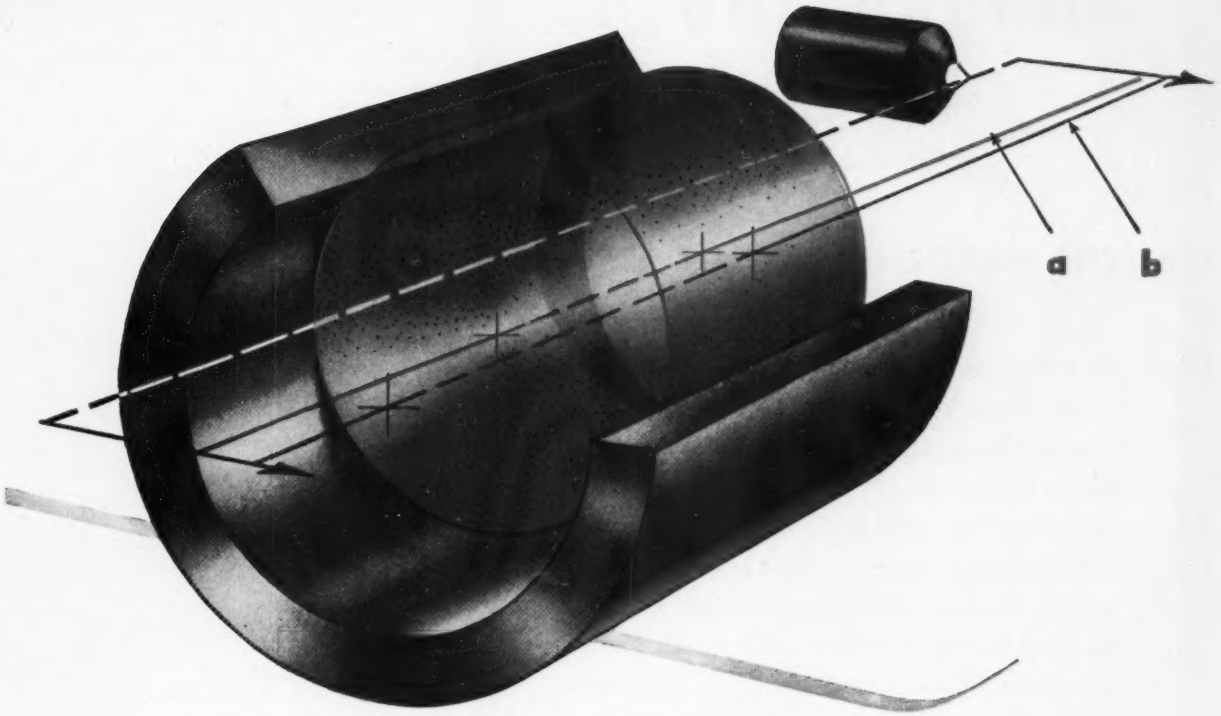
no. 1460

For production or single piece hole grinding on parts up to 60" diameter. Max. traverse stroke, 21". Max. grinding length, 16".



no. 2209

For precision and high production grinding of ball bearing races, gears, rolls, bushings, etc. Max. traverse stroke, 6". Max. grinding length, ¾".



THE heart of the internal grinding process is the line of contact between the wheel and the work. This contact line must be straight for the full length of the wheel and the full length of work as the wheel traverses. If the contact is not a straight line, the internal grinder is "out of line". Improper alignment may show up in the work as incorrect hole geometry (bell-mouth or taper) and poor surface finish. In addition, excessive wheel wear and poor wheel action may result.

Several elements contribute to the straightness of this line of contact: first, the path along which the wheel is traversed "a" must be a straight line; second, the axis of the wheel must lie in a plane parallel to the wheel path "a", and third, the axis of the work "b" must be parallel to the wheel path "a". For production grinding, the diamond must lie in the plane established by the wheel axis and the work axis.

Perfect alignment means that the slides must be straight and true, the wheel and work spindles must be in line and "zeroed" for center heights and the diamond must be on "dead center" of the wheel. A full, straight line of contact will extend wheel life, improve wheel action, and will assure correct geometry and required finish.

Bryant Chucking Grinder Company
Springfield, Vermont, U. S. A.

Internal grinders • Internal & External thread gages

OVER ONE HUNDRED YEARS OF CONTINUOUS SERVICE. ROUNDS, SQUARES, FLATS, HEXAGONS, OCTAGONS

BILLETS AND FORGINGS FOR PRODUCTION, TOOL ROOM AND MAINTENANCE REQUIREMENTS

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OIL HARDENING TOOL STEEL

WL introduces *"Whelco"*—a new tool steel of M grade—a new steel of maximum toughness, hardness and strength—a steel to assure maximum results at low cost! *"Whelco"* offers great penetration of hardness, great toughness at high hardness, wide hardening range, fine grain structure, and desirable non-deforming characteristics. *"Whelco"* has good forging properties and is readily machinable in the annealed condition. All **WL** warehouses stock *"Whelco"* M tool steel in a wide variety of flats and squares. Call your nearest **WL** man for a trial order—the results will speak for themselves!

WL steels are metallurgically constant. This guarantees uniformity of chemistry, grain size, hardenability—thus eliminating costly changes in heat treating specifications.

Write today for your FREE COPY of the Wheelock, Lovejoy Data Book, indicating your title and company identification. It contains complete technical information on grades, applications, physical properties, tests, heat treating, etc.

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American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17 N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

BORING BARS

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Erickson Tools Div., Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lovejoy Tool Co., Inc., Springfield, Vt.
Madison Mfg. Co., Muskegon Heights, Mich.
Neise, Karl A., Dept. M, 381 Fourth Ave., New York 16, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING, DRILLING AND MILLING MACHINES, Horizontal

(Floor, Planer or Table Types)

Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Portage Machine Co., 1069 Sweitzer Ave., Akron 11, Ohio.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Chandler Tool Co., 514 Ohio Ave., Muncie, Ind.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Neise, Karl A., Dept. M, 381 Fourth Ave., New York 16, N. Y.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Chandler Tool Co., 514 Ohio Ave., Muncie, Ind.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.

(Continued on page 294)

WE FORESEE YOUR DIEMAKING NEEDS ...and meet them!

More than 30 years' *past* experience in supplying diemakers' needs has taught Danly how to foresee *future* needs. In almost every instance, there are *standard* Danly Die Sets and *standard* Danly Diemakers' Supplies to meet your diemaking specifications.

You can rely on Danly's reputation for precision and dependability when you start your tooling program. You can be sure of prompt delivery from completely stocked Danly branch assembly plants located in nearly every major toolmaking center.

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A NATIONWIDE BRANCH PLANT SYSTEM

**Indicates complete stock*

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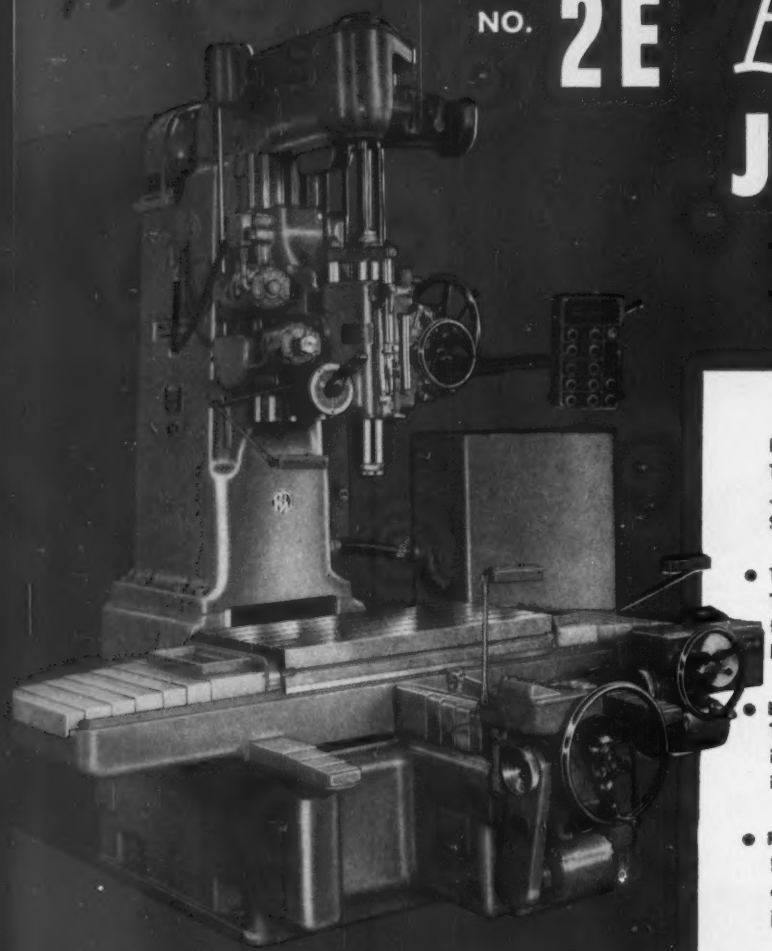
NOW

THE NEW PRATT & WHITNEY NO. 2E *Electrolimit* JIG BORER

THE PRACTICAL SIZE FOR THE AVERAGE TOOL ROOM



There is no better Jig Borer available anywhere at any price than this new Pratt & Whitney Number 2E. As a result of the knowledge gained in producing the 1E and 4E Jig Borers, it incorporates every detail of job-proved advanced design features, metallurgical control, manufacture and inspection that can contribute to fast, accurate performance and convenient operation. This outstanding machine tool brings you the full benefit of Pratt & Whitney's research facilities, modern production equipment, honest craftsmanship and experience from nearly a century of successfully serving industry throughout the world.

Wherever high-precision work must be produced rapidly and dependably day after day, the Pratt & Whitney 2E Jig Borer is the first choice to meet your needs best.

BRINGING THESE OUTSTANDING ADVANTAGES OF THE PRATT & WHITNEY SERIES "E" *ELECTROLIMIT* JIG BORERS TO YOUR MANY SMALL AND MEDIUM SIZED, HIGH-PRECISION JOBS

- **THE NEW P&W *Electrolimit* MEASURING SYSTEM**
  This entirely new method of locating the table is extremely fast, accurate and easy to use. Wear is eliminated and the high original precision is retained indefinitely.

- **EXCLUSIVE PRECISION PRELOADED BALL ROLL QUILL**
  The hardened, ground and lapped spindle quill "roll-feeds" in a preloaded ball roll mounting. Accuracy to "tenths" is assured indefinitely without maintenance or adjustment.

- **P&W OPEN SIDE CONSTRUCTION**
  Large, irregular shaped work pieces are handled with a convenience and speed impossible with any other type of jig borer construction.

- **AMPLE CAPACITY**
  Table working surface is 22" x 44", longitudinal travel 36" and transverse travel 22". Table top to spindle end, maximum, is 27"; special columns 6" and 10" higher than standard can also be supplied.

PRATT & WHITNEY *End Measure* JIG BORERS
Pratt & Whitney will continue to manufacture its famous line of Jig Borers equipped with End Measures, featuring the same high precision construction and performance as the Series "E", but without the Electrolimit Measuring System.

Other PRATT & WHITNEY *Electrolimit* JIG BORERS

NOW IN PRODUCTION:

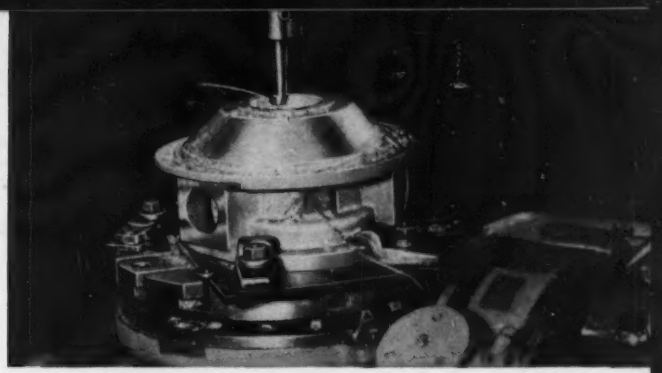
THE 1E Compact and versatile with table sizes of 12" x 24" and 12" x 42".

THE 4E Largest precision jig borer built with 36" x 72" rectangular table or combination rectangular and built-in 48" rotary table.

AND ON THE WAY:

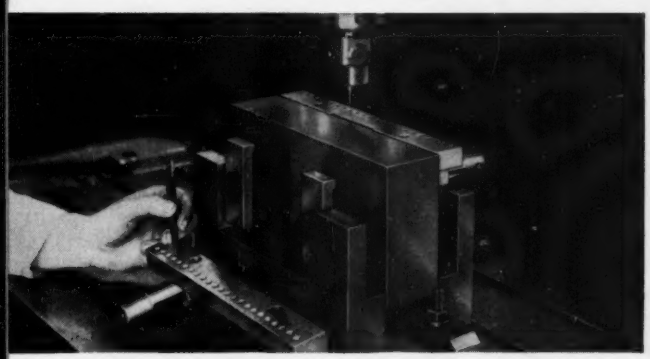
THE 3E Intermediate capacity with a 28" x 56" table.

Machining of components for this big die, 48" square, is handled with a P&W 20" Rotary Table on a Pratt & Whitney Jig Borer. A total of 160 holes on the die ring and punch pad are drilled and bored to a tolerance of ±.0001" making possible a uniform fit in any combination of assembly.

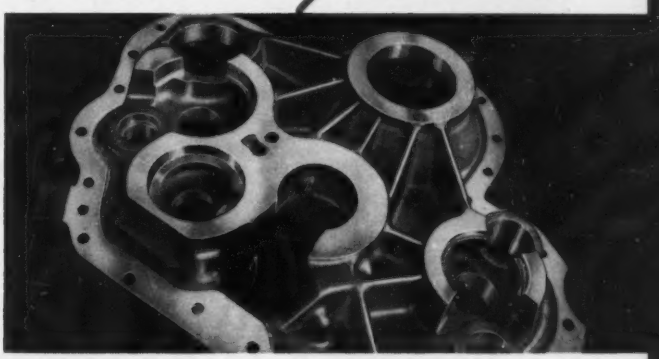


Here a casting is precision machined on a P&W Jig Borer with a P&W Tilting Rotary Table. Using only ordinary hold-down clamps, 13 holes are bored, 2 surfaces faced and 3 more surfaces precision milled *in a single setup*. No special fixtures are required.

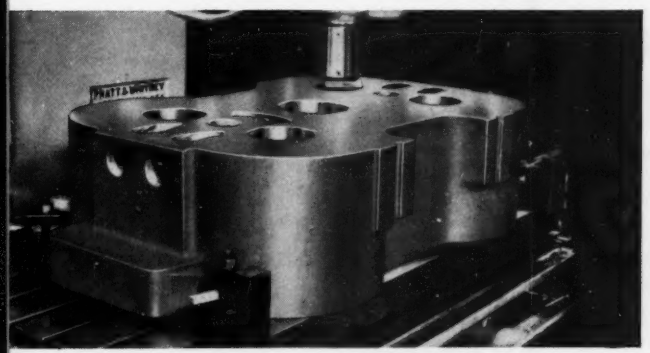
YOU CAN PUT *Performance like this* TO WORK IN *Your Plant*



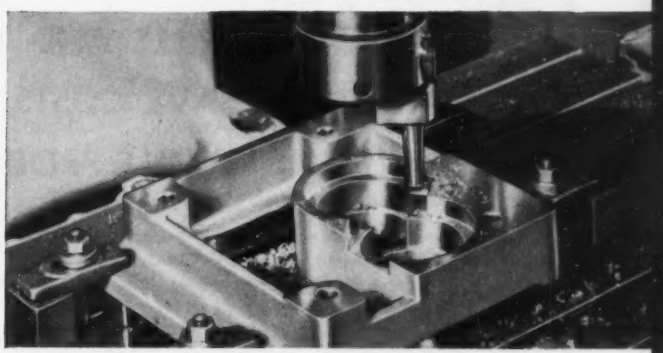
One of these punch and die bars requires 23 holes .1875" in diameter; the other requires 23 holes .3120" in diameter. Using a P&W Jig Borer, they are all single point bored to a tolerance of +.0000", —.0002"; center distances of .5000", ±.0002" and a permissible accumulated error of only ±.0005"



Extreme, dependable accuracy is a "must" in the Aviation Industry. That's why a Pratt & Whitney Jig Borer is used to machine the aluminum alloy aircraft engine part to "tenths" limits. Operations include drilling, boring, facing and precision milling.



Machining this big Meehanite casting for a hydraulic pump, calls for five holes approximately 5" in diameter, precision bored to a tolerance of .0005" for spacing and hole size. A Pratt & Whitney Jig Borer does the job rapidly, dependably, economically.



Shown here is a single point boring operation on one of the four overlapping holes in a machine gear box adapter. The four diameters in each of these two bearing seats are precision bored to a tolerance of .0005" using a Pratt & Whitney Jig Borer.

Write on your Company letterhead for Cir. No. 559.

PRATT & WHITNEY
DIVISION NILES-BEMENT-POND COMPANY
WEST HARTFORD 1, CONNECTICUT, U. S. A.

First Choice for *Accuracy*

BRANCH OFFICES . . . BIRMINGHAM • BOSTON • CHICAGO • CINCINNATI • CLEVELAND • DALLAS (The Stanco Co.) • DETROIT • HOUSTON (The Stanco Co.)
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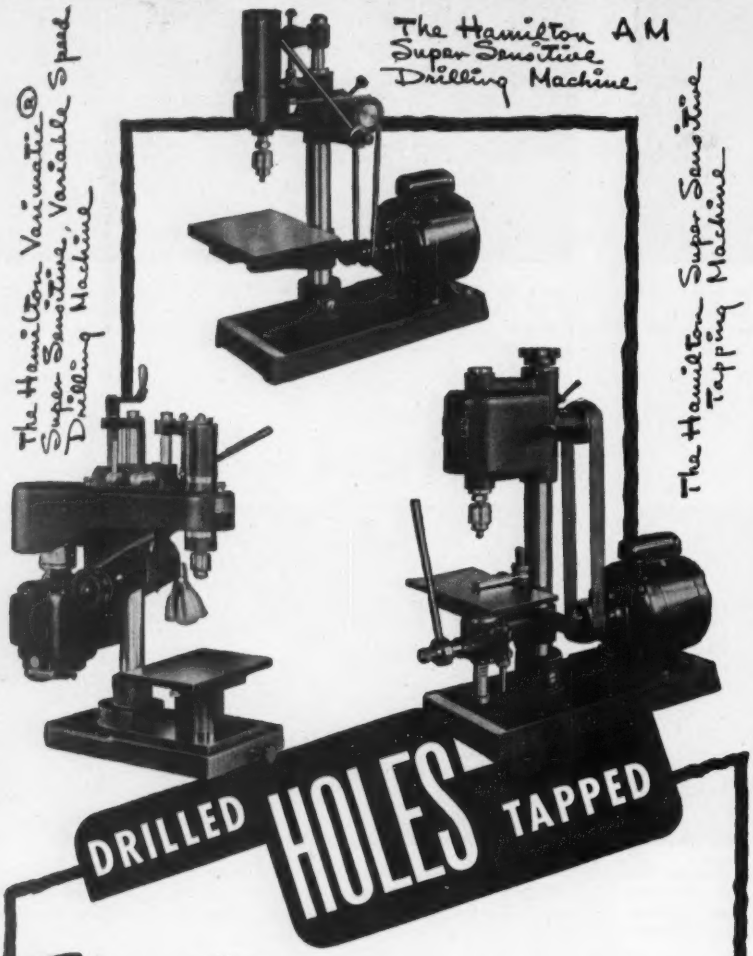
MACHINE TOOLS • CUTTING TOOLS • GAGES



Hamilton DRILLS AND TAPPERS MAKE TIME, SAVE COSTS ON ACCURATE SMALL HOLE PRODUCTION

Small holes . . . *tiny holes* . . . in materials of such diverse characteristics as fiber and monel, ceramic and bronze, are being drilled and threaded speedily, accurately, *profitably* . . . NOW . . . by thousands of Hamilton Drills and Tappers.

The Hamilton VARIMATIC® DRILL,
The Hamilton A-M DRILL,
The Hamilton TAPPER,

each a bench type, super-sensitive machine with ample clearances and travel, incorporate such precision that work is always held well within the tolerance allowed, and such stamina that they maintain their accuracy year after year even under heavy production loads. Our *free* Bulletin No. V-472 provides full information including specifications. Write now! Tomorrow you may need the information.

THE Hamilton TOOL COMPANY
HAMILTON • OHIO • U • S • A

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American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Wales-Strippit Corp., North Tonawanda, N. Y.

BORING TOOLS

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Atrax Co., Newington, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lovejoy Tool Co., Inc., Springfield, Vt.
Madison Mfg. Co., Muskegon Heights, Mich.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Bliss, E. W., Co., 1375 Raff Road, S. W., Canton, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Columbia Machinery & Engineering Corp., Hamilton 1, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Detroit Broach Co., 20201 Sherwood Ave., Detroit, Mich.
duMont Corp. (Hand, for keyway cutting), Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINES

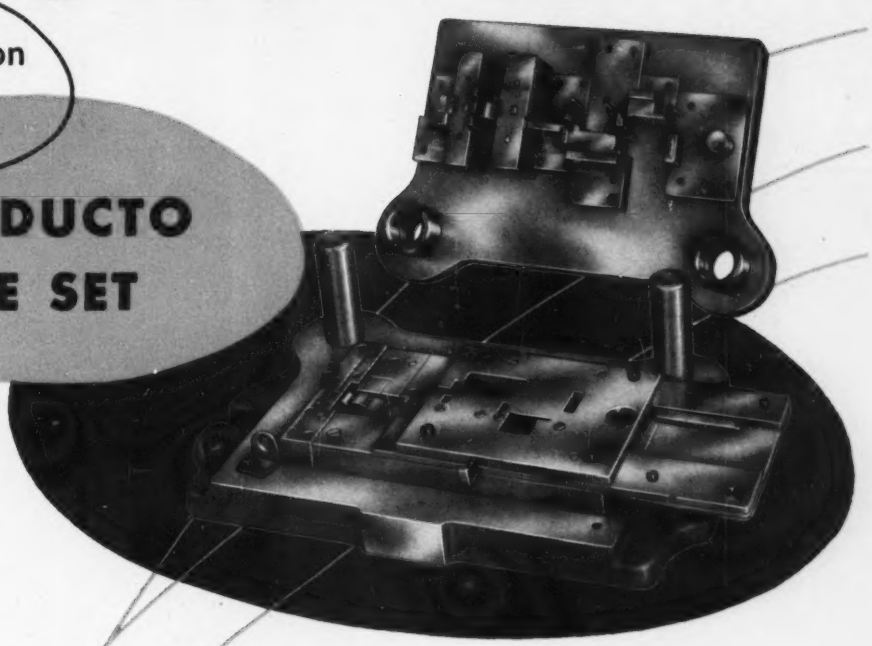
American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.

(Continued on page 298)

teamed precision of die and

PRODUCTO DIE SET

makes this intricate job possible



THE fuse terminal, shown below, is produced by the Federal Electric Products Co. for use in their Noark front operated safety switch. A Producto Die Set was selected to maintain the precise production of a top quality die at high speed operation.

Material is half hard 3/32″ copper (Rockwell 30-40 B scale), automatically fed to a Niagara 40 ton press. The progressive die stations are 1) pierce and stamp, 2) notch, 3) lance and emboss, 4) form 5) finish form. Die is held to extremely close tolerances. Production: 4000 pieces (1-3/16″ x 2-1/8″) per hour, 70,000 between grinds.

Today's production calls more than ever for quality control . . . which, in die work, necessitates the best in die sets. Call for Producto . . . and be sure!

the **PRODUCTO MACHINE COMPANY**

985 HOUSATONIC AVENUE

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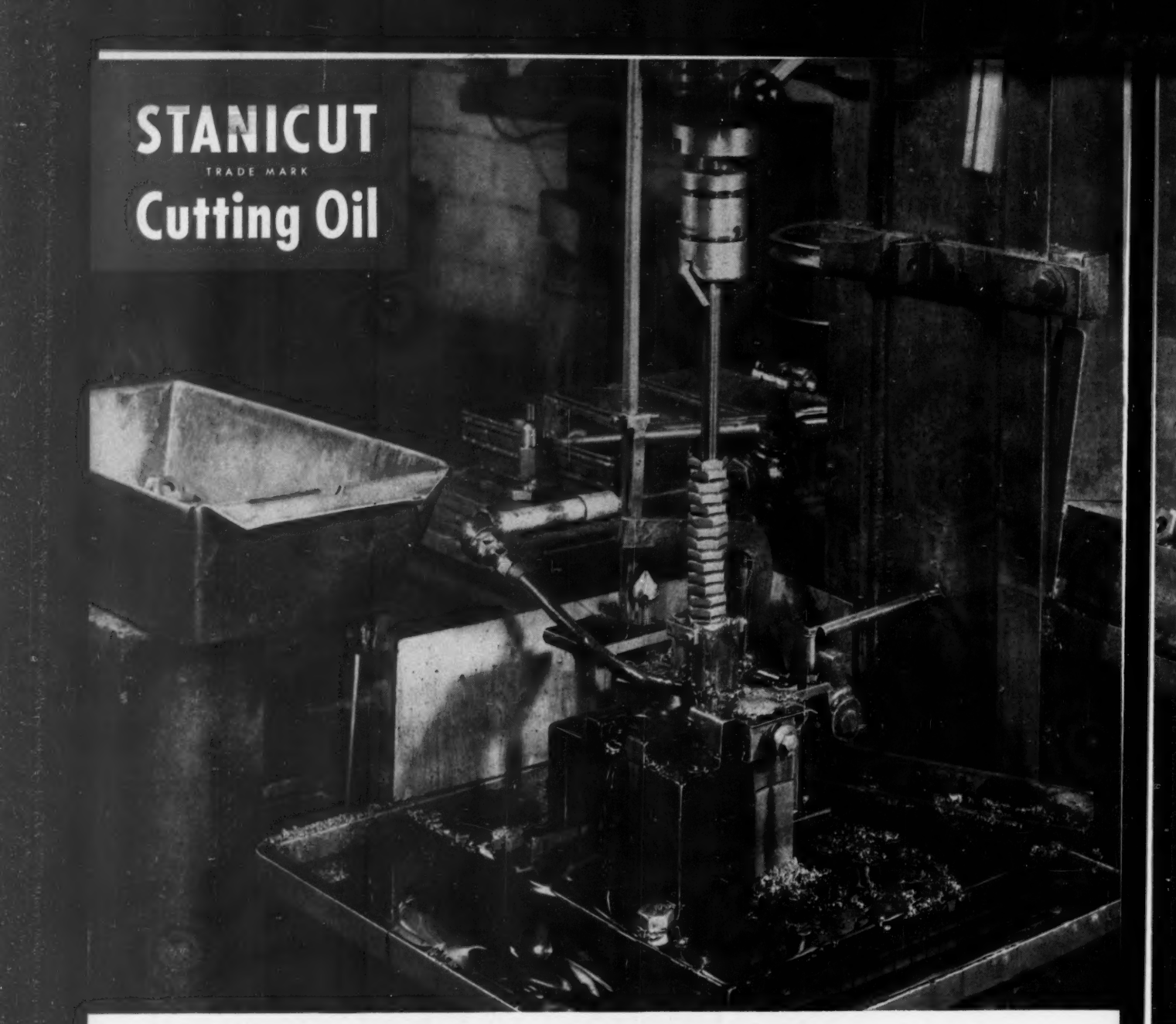


Tapping problem solved; production boosted 25%

● A midwest manufacturer was having trouble with a thread tapping operation. Performed on the drill press shown above, the job called for the tapping of a ¾-inch threaded hole in nuts made from C-1018 steel stock. The quality of threads tapped was poor. Rejections ran high because of torn threads.

Consulted on this problem, a Standard Oil lubrication specialist recommended the use of STANICUT Cutting Oil 309 BCS. Replacing a conventional cutting fluid, STANICUT turned the tide on troubles. With its use, quality of threads has been excellent. Rejections have been reduced to a minimum. Production has been boosted 25% — an increase of approximately 100 pieces per hour!

Whatever your cutting oil problem, the Standard Oil lubrication specialist in your section of the Midwest can help you solve it. Backed by one of the most complete lines of cutting oils on the market, he has the training and experience to apply those products most effectively. You can contact him by phoning your local Standard Oil (Indiana) office. Or write: Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

What's YOUR problem?

D. F. Wallace of the Standard Oil office in Saginaw, Michigan, is the lubrication specialist who helped this midwest manufacturer solve a serious problem through the use of STANICUT Cutting Oil.

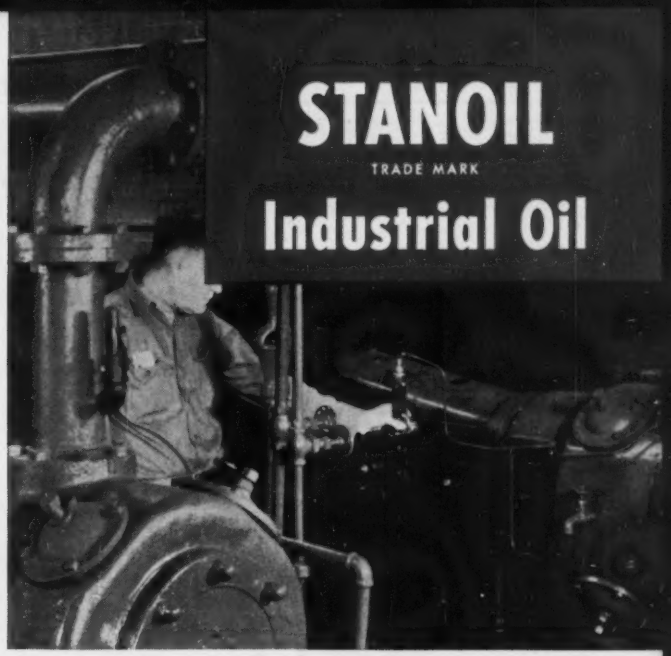
Like all Standard Oil lubrication specialists, he has a broad background of practical experience plus thorough training in Standard's own schools. And like all lubrication specialists, his on-the-job help is always available. He is one of a corps of experienced men who make their headquarters wherever industry is located throughout the Midwest.

For help with your problem, call for the services of your Standard Oil lubrication specialist today! A call to your local Standard Oil office is all that's necessary.

STANDARD

STANDARD OIL COMPANY
(INDIANA)

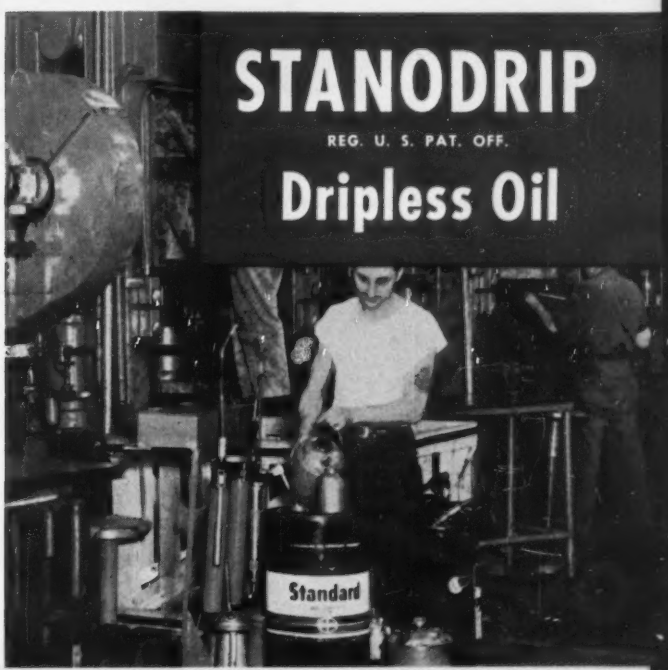
STANOIL
TRADE MARK
Industrial Oil



Compressors give carbon the air. Hayes Industries, Jackson, Michigan, had air compressor trouble caused by formation of carbon on valves. With the change to STANOIL Industrial Oil, compressors gave the air to carbon troubles and have breezed through four years of hard operation without difficulty. Over the oil previously used, STANOIL has given four times longer service in crankcases.

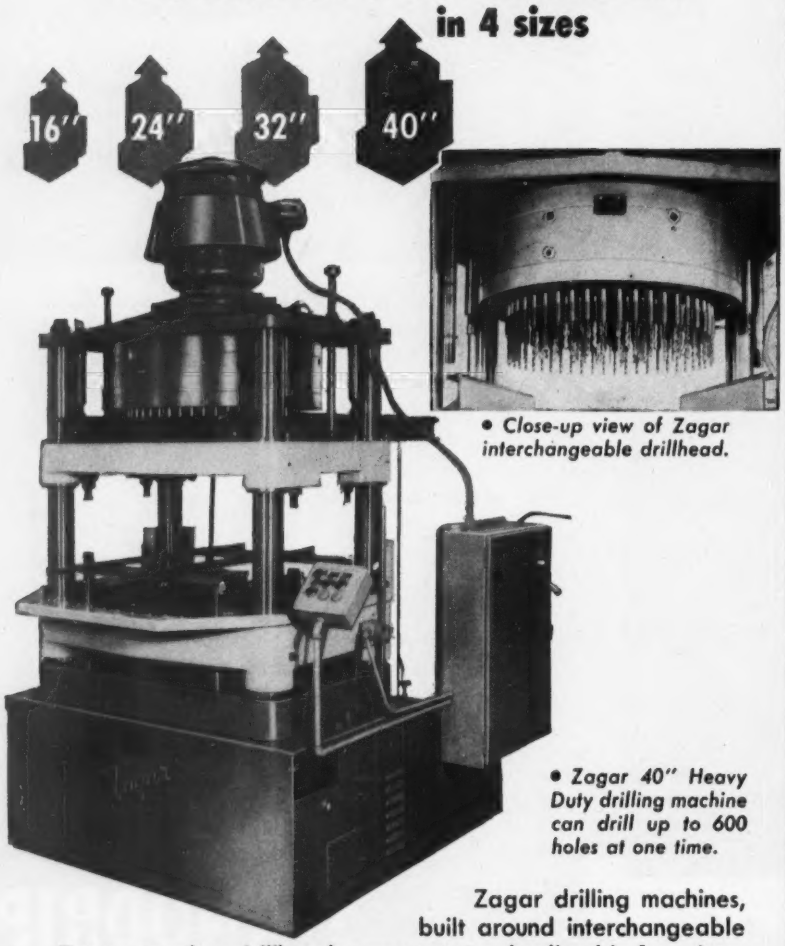
No drips in this press room. STANODRIP Dripless Oil solved a press room lubrication problem at A. O. Smith Corporation Kankakee Works. It put a stop to drippage of oil from bearings on stamping and punch presses. Results: cleaner and safer working conditions, less lubricant consumption, fewer applications of lubricant.

STANODRIP
REG. U. S. PAT. OFF.
Dripless Oil



NEW Zagar HEAVY DUTY 40" DRILLING MACHINE

Successful line is now standardized in 4 sizes



• *Close-up view of Zagar interchangeable drillhead.*

• *Zagar 40" Heavy Duty drilling machine can drill up to 600 holes at one time.*

Zagar drilling machines, built around interchangeable Zagar gearless drillheads, are now standardized in four sizes. The new heavy duty 40" machine lifts the scope of the line to such jobs as turbo-jet engine frames. Yet simplicity of design enables set-ups to be made or changed over in a few hours. You get greater horsepower, thrust, and rigidity and better alignment than in conventional drill presses. Greatly broadened, therefore, is Zagar's facility for drilling any number of holes at one pass, in any pattern on centers as close as twice drill diameter.

ZAGAR TOOL, Inc.

24000 Lakeland Blvd., Cleveland 23, Ohio

Write for Engineering Manual M-1.

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Johnson Bronze Co., New Castle, Pa.

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Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md. (Portable Elec.).
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

BULLDOZERS

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Atrax Co., Newington, Conn.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Calif.
Kling Bros. Engineering Works, 1320 No. Kostner Ave., Chicago 51, Ill.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BURS

See Files and Burs, Rotary.

BUSHINGS, Brass, Bronze, Carbide, Etc.

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Johnson Bronze Co., New Castle, Pa.
Kennametal, Inc., Latrobe, Pa.

BUSHINGS, Hardened

Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.

BUSHINGS, Jig

Colonial Bushings, Inc., P. O. Box 37, Harper Sta., Detroit, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

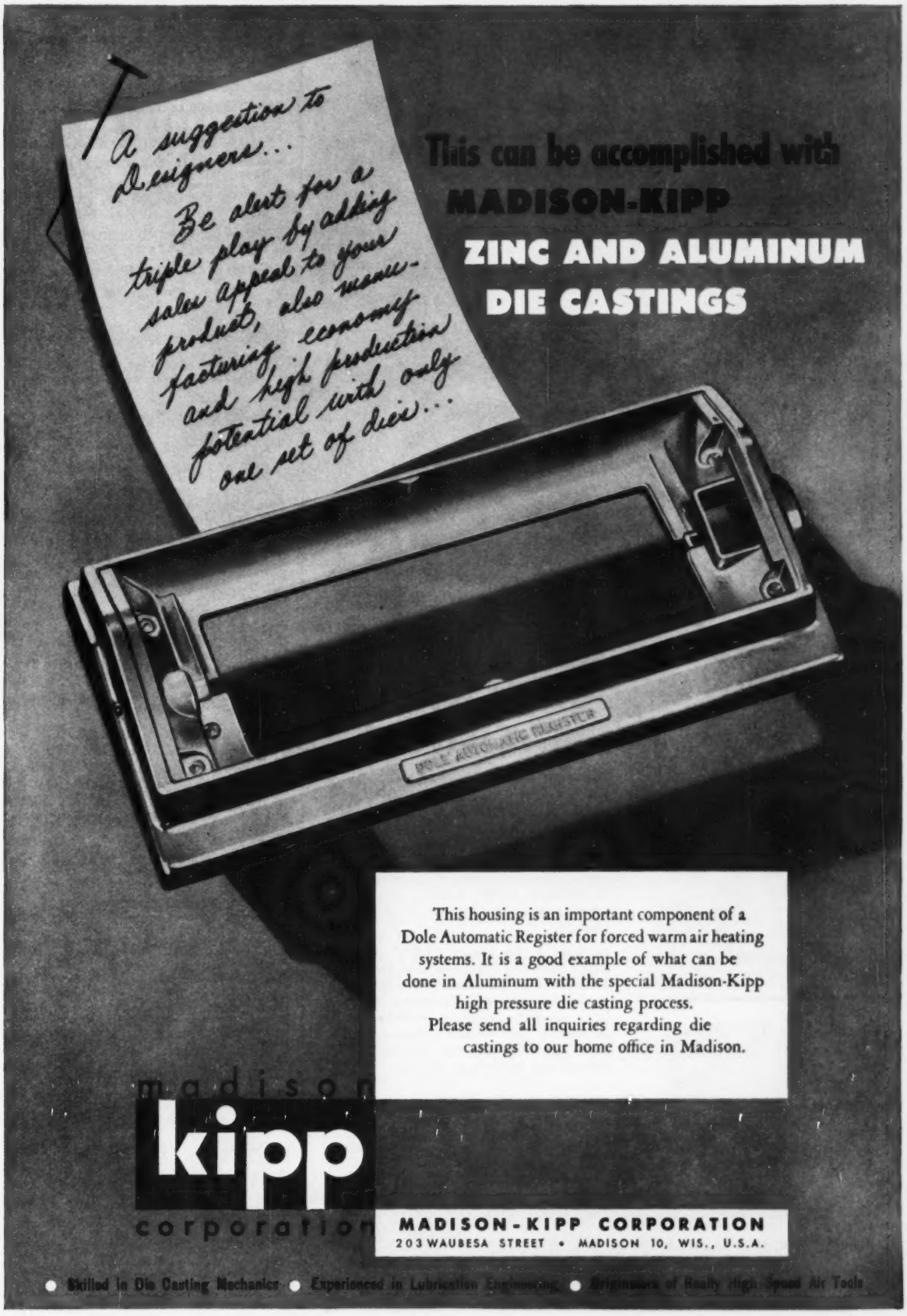
CABINETS, Tool

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

CALIPERS

Ames, B. C., & Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Homestrand, Inc., Larchmont, N. Y.
Inter-Continental Trading Corp., 90 West St., New York 6, N. Y.
Millers Falls Co., Greenfield, Mass.

(Continued on page 300)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Be alert for a triple play by adding sales appeal to your product, also manufacturing economy and high production potential with only one set of dies...
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This housing is an important component of a Dole Automatic Register for forced warm air heating systems. It is a good example of what can be done in Aluminum with the special Madison-Kipp high pressure die casting process.
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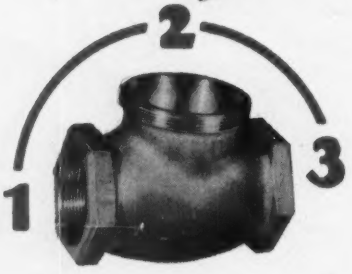
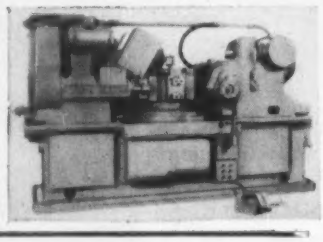
ALL finishing operations...

MEANS GREATER ACCURACY *with* **GOSS DeLEEUW**





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One of the many important advantages being realized with this new chucker is the performing of ALL finishing operations on a single chucking of the work. In addition to the time saved, this feature, exclusive with Goss & De Leeuw "1-2-3" machines, means only one handling of the work with an attendant greater accuracy. This machine is in a class by itself in precision finishing.

In Goss & De Leeuw "1-2-3" Automatic Chucking Machines, one, two, or three ends of the work are machined simultaneously or in sequence. There is no need for resetting, retooling or secondary operations. More work from one machine and greater accuracy are matters of record.

Ask for illustrated literature describing the operation of this chucker in detail. Send samples of your work for time and cost estimates.

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Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

CAM CUTTING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CAM MILLING AND GRINDING MACHINES

Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Waynesboro, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rowbottom Machine Co., Sheffield St., Waterville, Waterbury, Conn.

CAMS

Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kux Mch. Co., 3930 W. Harrison St., Chicago, Ill.
Rowbottom Machine Co., Sheffield St., Waterville, Waterbury, Conn.
Vinco Corp., 8855 Schaefer Highway, Detroit 27, Mich.

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Rooseveit Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

CASEHARDENING FURNACES

See Furnaces, Heat-Treating.

CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.

CASTINGS, Die

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Iron

Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.

CASTINGS, Steel, Alloys, Etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Lebanon Steel Foundry, Dept. J, Lebanon, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

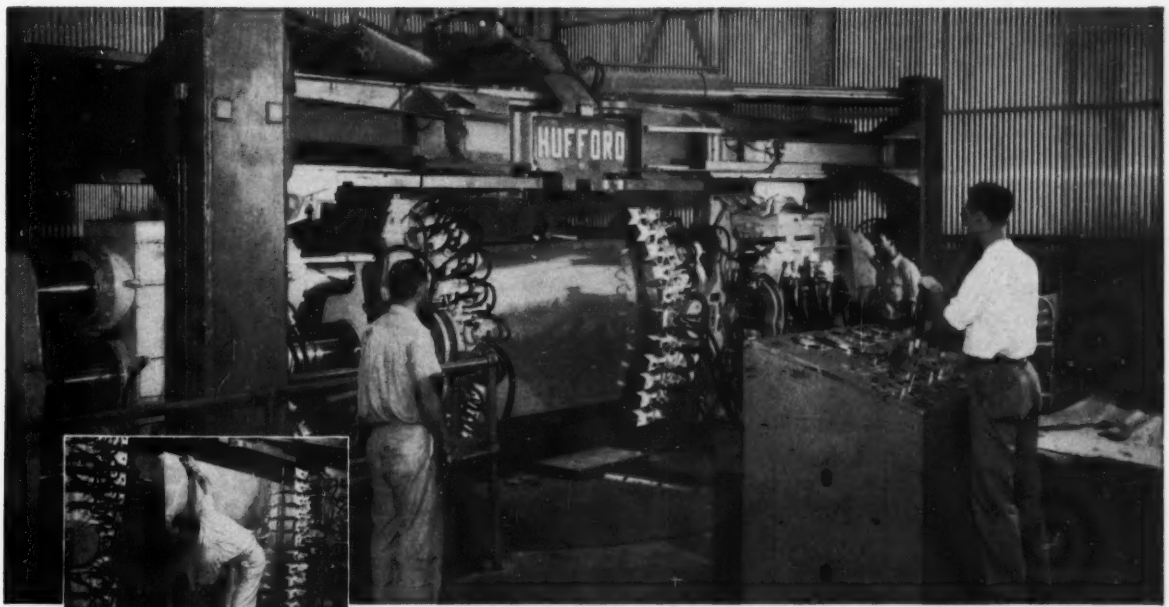
CEMENT, Disc Grinding Wheel

Besly-Welles Corp., Beloit, Wis.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

(Continued on page 302)

Newest NEWS in Aircraft Manufacture

the Hufford HYDRA-CURVE sheet jaws



This Model 46 Hufford Stretch-Wrap Machine, located at North American Aviation, Inc., Inglewood, California, shows the new Hufford Hydra-Curve Jaws pre-shaping the sheet to match the vertical die contour. The arms wrap back to produce finished parts.

Jaws assume a straight vertical line for easy loading. Jaw positions, straight or curved, are made from the operator's control pedestal.

Note the extreme curvature possible with the new Hufford Jaws.

These "S" curves, possible in either direction, show the flexibility of the Hufford Hydra-Curve Jaws.

All photos courtesy North American Aviation, Inc.

They ease forming problems, cut material costs, reduce sheet losses through breakage.

Here's the newest step in aircraft manufacture—another "FIRST" for Hufford, *pioneers and developers of the famous stretch-wrap forming process!*

THE NEW HUFFORD HYDRA-CURVE JAWS ease the forming of metal skins which are an important structural part of each plane. Used on the huge Hufford stretch-wrap forming machines, these new jaws are loaded in a straight, upright position—*but look what happens when the jaws begin to function!*

Out of the many possible curvatures the jaws can assume, sheets are easily pre-curved to match the cross sectional contours of the die. Stretching and wrapping around the die then completes the forming of the finished part.

ADVANTAGES? Yes . . . *Big* savings in material costs; better, faster forming; lower transitional area stresses and a minimum of losses resulting from sheet breakage!

These new curvable jaws again prove that *Stretch-Wrap Forming at its best comes FIRST from Hufford!*

HUFFORD
Machine Works Inc
EL SEGUNDO CALIFORNIA

Manufacturers of

Easily adjustable head and table speeds changeover from job-to-job...

New Heavy-Duty Alfing Drill Press

Immediate delivery from stock

Just turn the crank to raise or lower the table—slide the headstock 6" up or down by hand—lock in position—and the Alfing Drill Press is ready to go to work on your short- or long-run heavy duty production jobs. Easy-to-reach controls cut your handling time, too.

Built to take it, the Alfing Model BK-25 combines all the operating advantages that made it one of Europe's top producers for 40 years, *plus* many new design features to meet the operating requirements of American mass-production...like these:

Adjustable table and headstock. Scraped ways assure accurate alignment.

9" quill-supported spindle stroke, driven by V-belt motor.
Motor speed 900 rpm.

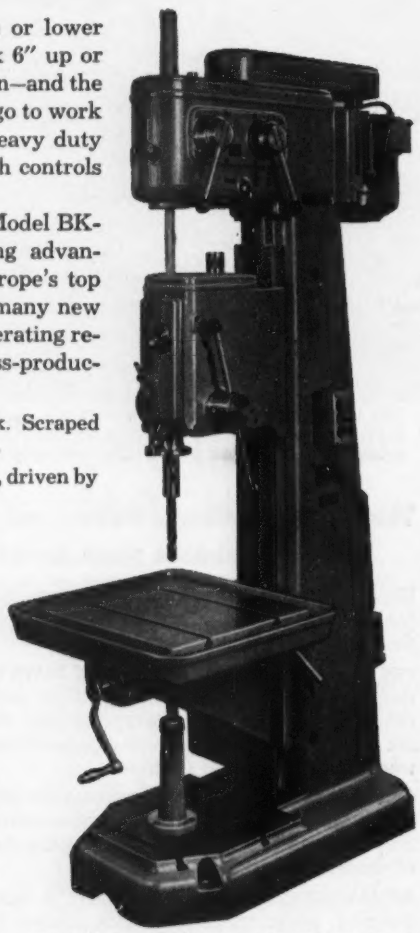
Drilling capacity of 1" in steel; 1¼" in cast iron.

Adaptable for boring, countersinking, milling and reaming.

8 spindle speeds from 150 to 1640 rpm in geometrical progression. Spindle carried in precision ball bearings.

Drilling feed by hand or power. With power, feeds of .003", .006" or .009" per spindle revolution are available. Power feed may be engaged or disengaged at any position of spindle. Drilling depth set by quick indexing stop.

Want more details on this and other Orban equipment? Write today.



New Alfing BK-25 Drill Press with 26" x 28" table surface. Distance between spindle and table, 23" max.; spindle and base plate, 25"-40".

Engineered servicing and stock parts within 48 hours from Orban Service Centers in Newark, Detroit, Cleveland.

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Canadian sales by European Machinery Ltd., 11 King St. West, Toronto, Can.

CENTERING MACHINES

Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CENTERS, Lathe

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Houston Grinding & Mfg. Co., 2110 Quitman St., Houston 10, Tex.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Neise, Karl A., Dept. M, 381 Fourth Ave., New York 16, N. Y.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.

CHUCKING MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co. (Multiple Spindle), 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Air Operated

Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Calif.
Logansport Machine Co., Inc., Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Collet or Split

See Collets.

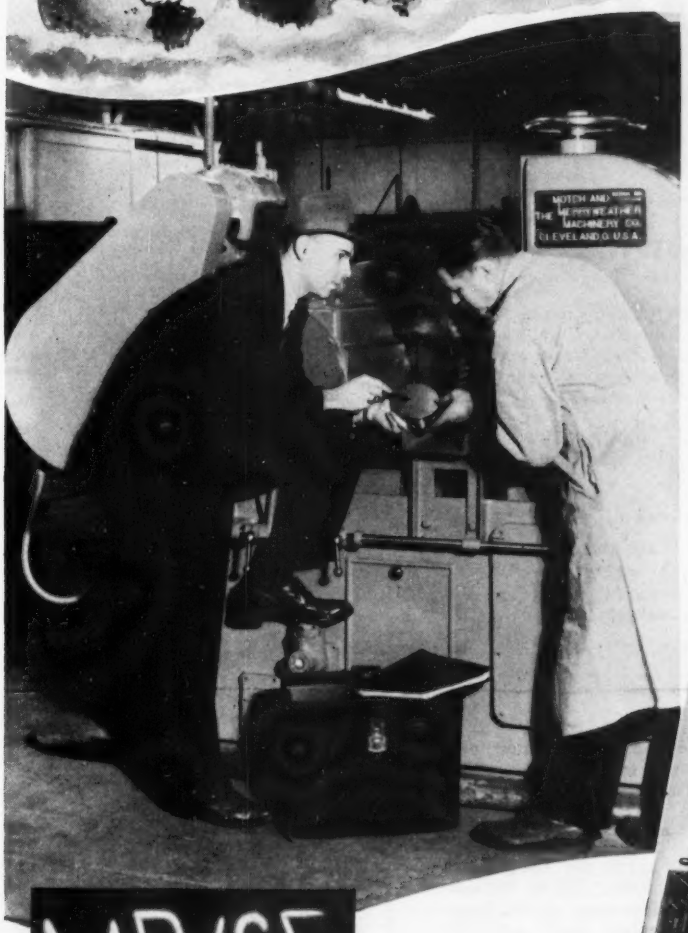
CHUCKS, Diaphragm

Van Norman Co., 2640 Main St., Springfield 7, Mass.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

(Continued on page 304)

NOWHERE ELSE on earth....

can you command Motch & Merryweather's *Unrivalled Experience!*



...A KNOW-HOW THAT SPRINGS FROM MANY YEARS OF BUILDING CIRCULAR SAWING MACHINES, BLADES AND BLADE GRINDERS, AND CORRELATING "ALL 3" PROFITABLY ON THE JOB

Motch & Merryweather's unmatched experience in the field of circular sawing brings you a know-how which insures profitable operation — *invariably.* To sign an order for an M. & M. machine is to be sure of complete satisfaction. Your purchase will perform as it should. We will see to that — *invariably.*

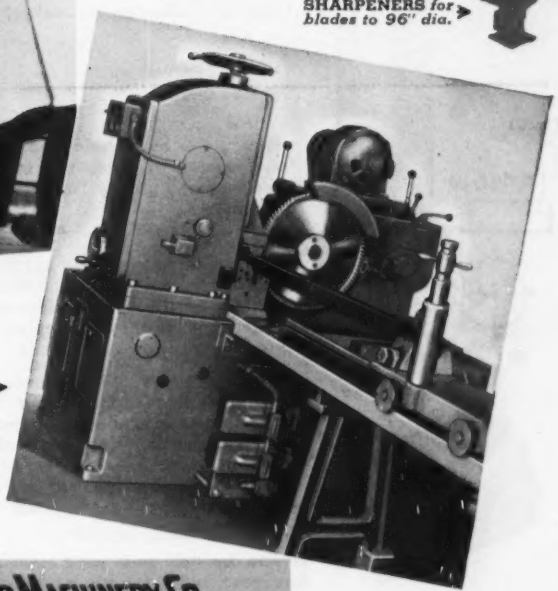
MACHINES *for cutting off to 36" dia.*

CUT-OFF BLADES *up to 96" dia.*

SHARPENERS *for blades to 96" dia.*

MP/SE

Most Productive Machine Per Dollar



• *Motch & Merryweather No. 2 Automatic Circular Sawing Machines cut off ferrous or non-ferrous metals up to 6" fast, clean, without burrs, profitably.*

Manufactured by — THE MOTCH & MERRYWEATHER MACHINERY CO. —

CLEVELAND 13, OHIO

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Only M & M builds ALL 3: CIRCULAR SAW SAW BLADE BLADE GRINDER

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For fast, practical solutions to tough tooling problems, call in the expert . . . your nearby Gorham Field Engineer! He provides a complete engineering service to determine your exact tooling requirements. For instance:

•

He starts with your product, sketch or idea.

•

He surveys your production operations and your available equipment.

•

He considers work material properties and desired finishes and tolerances.

•

He plots proper machine feed, speed and method of tool driving.

•

then . . . he develops practical design and engineering specifications for a special cutting tool, metallurgically "tailor-made" for your application.

•

. . . and his recommendations are backed by Gorham's unmatched facilities! These include three fully-equipped manufacturing plants, large Engineering and Metallurgical staffs, and the finest heat treating equipment.

These resources, plus Gorham's more than thirty years' reputation for producing the finest cutting tools, are dedicated to furnishing prompt and profitable solutions to your special tooling problems. Gorham-engineered "specials" are turning problems into profits in thousands of plants every day . . . why not let them do the same for *you?*

If you haven't met your nearby Gorham field Engineer, write for his name, or send details of your problem direct for recommendations.

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CHUCKS, Drill

Erickson Tool Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.

CHUCKS, Full Floating

Erickson Tools Div., Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.

CHUCKS, Gear

Horton, E., & Son Co., Windsor Locks, Conn.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

CHUCKS, Lathes, Etc.

Buck Tool Co., 220 Schippers La., Kalamazoo, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Erickson Tools Div., Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Gisholt Mch. Co., Madison 10, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Horton, E., & Son Co., Windsor Locks, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated

Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Quick Change and Safety

Erickson Tools Div., Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jarvis, Charles L., Co., Middletown, Conn.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Neise, Karl A., Dept. M, 381 Fourth Ave., New York 16, N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.

CHUCKS, Ring Wheel

Gardner Mch. Co., Div. Landis Tool Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Homestrand, Inc., Larchmont, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

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General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

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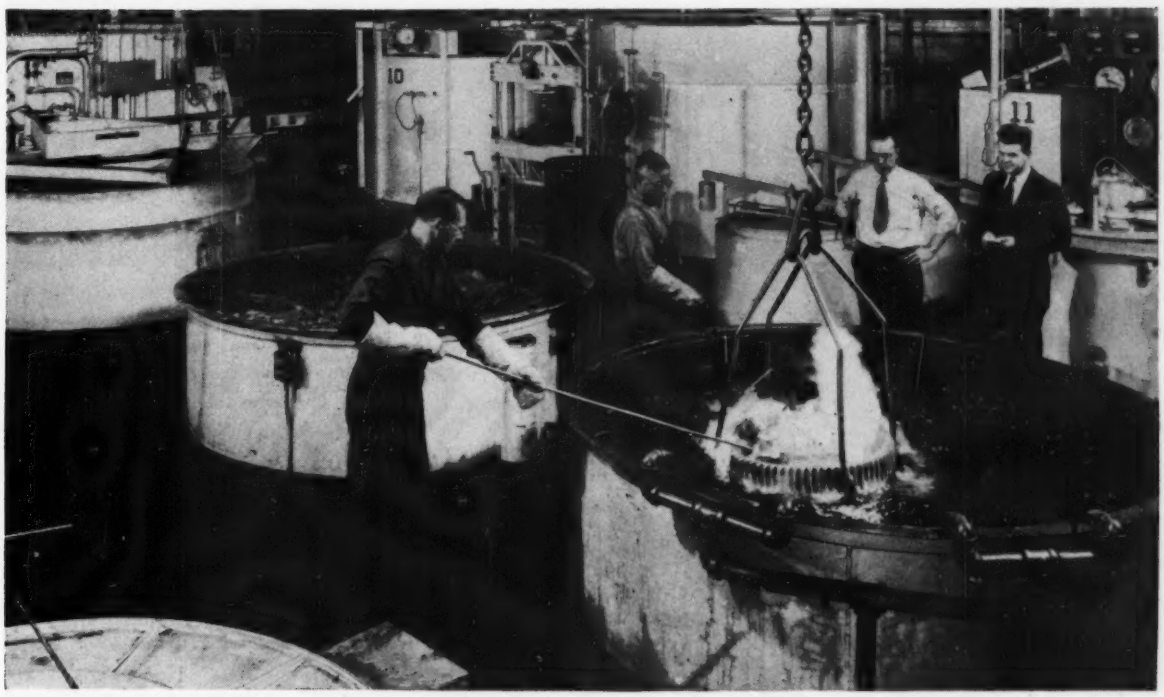
Bunell Machine & Tool Co., 1600 East 24th St., Cleveland 14, Ohio.

(Continued on page 306)

Want deeper hardness on low alloy steels without distortion or cracking?



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GULF SUPER-QUENCH is exceptionally fast — produces deep and uniform hardness on all types of alloy steels. Deeper and more uniform than is possible with conventional quenching oils. It is particularly effective on the substitute steels which have low hardenability characteristics.

Add the fact that GULF SUPER-QUENCH has the same minimum tendency to distort and crack as conventional quenching oils and you can see why GULF SUPER-QUENCH is often the difference between successful quenching and a high percentage of rejects.

No matter what alloys or shapes you quench, you will gain from the greater quenching power of GULF SUPER-QUENCH. Ask a Gulf Sales Engineer for further details on this outstanding quenching oil. Write, wire, or phone your nearest Gulf office.

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GULF REFINING COMPANY
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Here's the *right* start for an *exact* finish . . . Simonds bulletin on internal grinding wheels. It tells you *why* they're right . . . *why* they grind fast and cool . . . *why* they give the same high precision each time you order them.

You can have this bulletin free, together with the name of your Simonds distributor. He can supply you with Simonds Abrasive Company grinding wheels for every job . . . snagging, finishing, sharpening, cutting-off and polishing.

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Standard Shop Equipment Co., Inc., 8299 W. Tinicum Ave., Philadelphia, Pa.
Swartz Tool Products Co., Inc., 13330 Foley Ave., Detroit, Mich.

CLAMPS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Shop Equipment Co., Inc., 8299 W. Tinicum Ave., Philadelphia, Pa.
Starrett, The L. S., Co., Athol, Mass.
Swartz Tool Products Co., Inc., 13330 Foley Ave., Detroit, Mich.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

CLEANERS, Chemical, for Metal

Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
Oakite Products, Inc., 19 Rector St., New York N. Y.

CLUTCHES

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Link-Belt Co., 300 West Pershing Rd., Chicago 9, Ill.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.
Warner Electric Brake & Clutch Co., Beloit, Wis.

COLLARS, Safety

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS

Brown & Sharpe Mfg. Co., Providence, R. I.
Erickson Tools Div., Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira N. Y.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

COMPARATORS

See Gages, Comparator.

COMPARATORS, Optical

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Portman Instrument Co., Port Washington, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

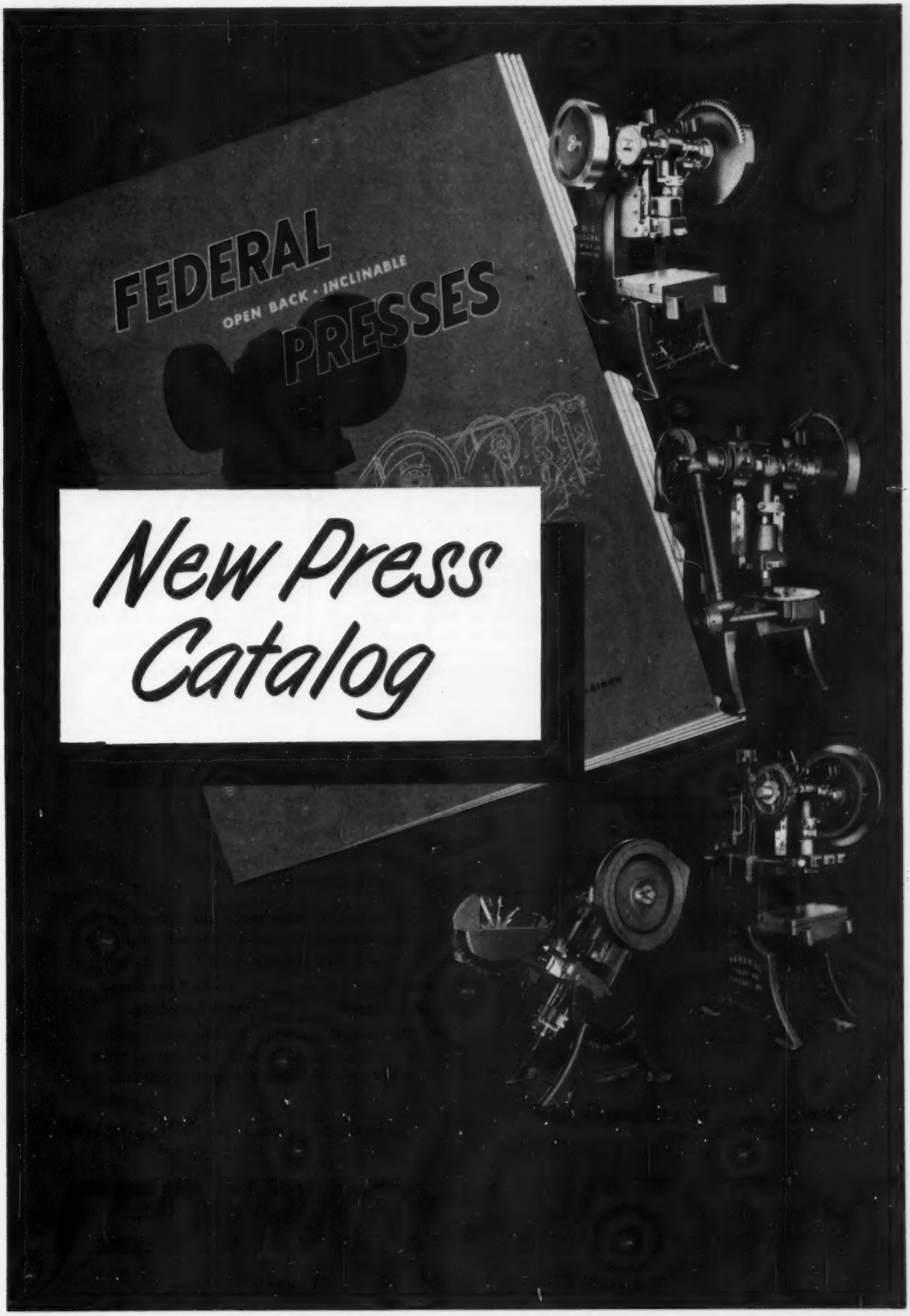
COMPOUNDS, Cleaning

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

(Continued on page 308)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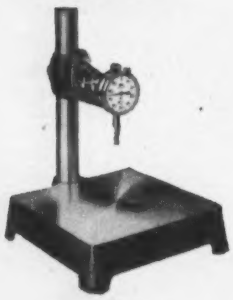
FOR *Strictly* IMPERSONAL INSPECTION CHOOSE AMES DIAL COMPARATORS

Ames Dial Comparators make the inspection of duplicate parts an extremely simple, rapid and accurate operation. Ames Comparators are strictly impersonal in their accuracy — the results being in no way dependent on the skill or judgment of the operator. The pressure of the gauging members against the work is mechanically determined and therefore uniform.

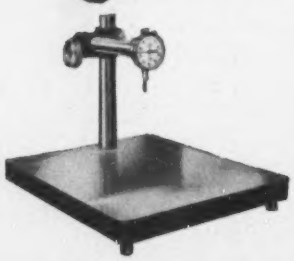
Check the Ames Dial Comparators shown — one of them may solve a Quality Control problem for you.

Ames No. 1 Dial Comparator is an easily adjustable bench model that measures objects up to 2" in cross section. The table bracket may be quickly located and locked in position on the column. The table itself may be further positioned and locked for final fine adjustment. This comparator is designated *Ames No. 1W* when equipped with dead-weight contact pressure and contact area to ASTM specifications for measuring resilient materials, such as rubber, plastics, etc.

Ames No. 2 Dial Comparator is a compact, stable bench model for measuring non-yielding materials — sheet metal, glass, hard rubber. The 2" diameter table is adjustable to bring pointer to zero. *Ames No. 2W* is similar to the Ames No. 2, but is furnished with dead-weight contact pressure and contact areas to ASTM specifications for checking textiles, plastics, sheet rubber, etc.



Ames No. 13 Dial Comparator features flat-ground, cast-iron base of ample size for using V-blocks and locating fixtures for checking rounds, flats and odd shapes. Also, the No. 13 can be fitted with a fine adjustment for close setting. Accurately adjustable bracket holds any Ames Micrometer Dial Indicator.



Ames No. 130 Dial Comparator is designed especially for inspecting comparatively large parts. For this reason, the flat-ground steel base, the adjustable indicator support on which can be mounted any Ames Micrometer Dial Indicator, and the upright column are proportioned to suit the user's particular requirements.

Send us your Quality Control job specifications, and we will supply complete details and proposal without obligation.

Representatives in principal cities. B. C. AMES CO. 27 *Ames Street* *Waltham 54, Mass.*

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Oakite Products, Inc., 19 Rector St., New York, N. Y.
Shell Oil Co., 50 West 50th St., New York, N. Y.
Sinclair Refining Co., 630 5th Ave., New York.
Standard Oil Co. (Indiana) 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

COMPOUNDS, Resin and Molding

Bakelite Co. Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER

Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

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Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bunell Machine & Tool Co., 1600 East 24th St., Cleveland 14, Ohio.
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Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Fellows Gear Shaper Co., Springfield, Vt.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Minster Machine Co., Minster, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

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General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

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Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

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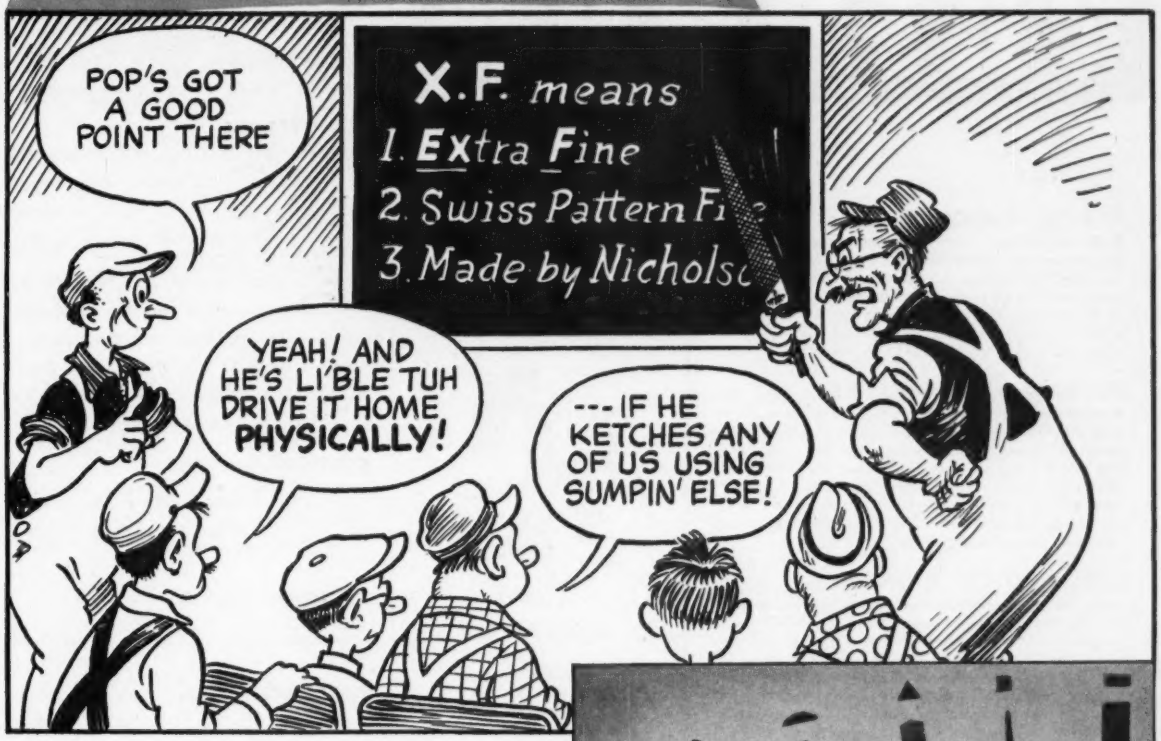
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.

(Continued on page 310)

POP'S school of Filing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3. Made by Nicholso
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THEY can't put anything over on Pop. He knows (as most good foremen know) that where there's precision filing to be done, there are specially precise files for doing it, viz.: Nicholson X.F. Swiss Pattern Files. He knows, too, that "X.F." means "*Ex*tra *F*ine." And for good reason: With 89 years' file-making experience and more Swiss Pattern production than any other manufacturer in America, Nicholson can well be expected to turn out the absolute tops in accurate shapes and cuts and the utmost in quality.

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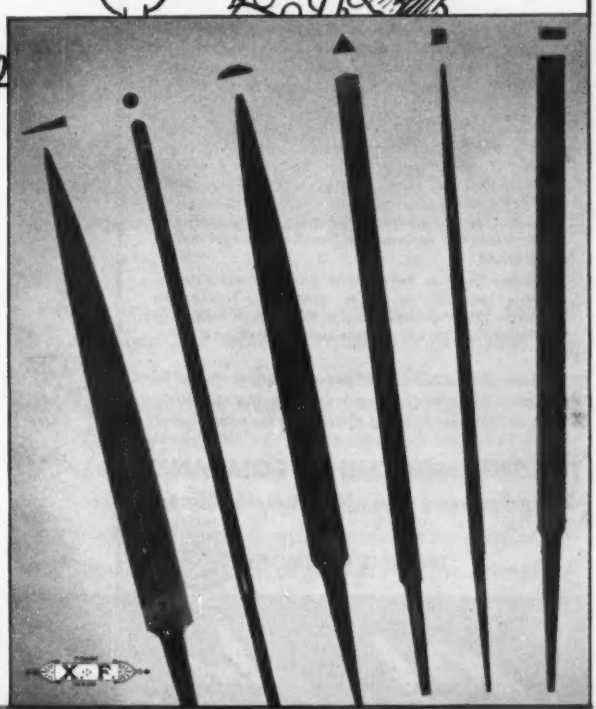

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NICHOLSON FILES FOR EVERY PURPOSE

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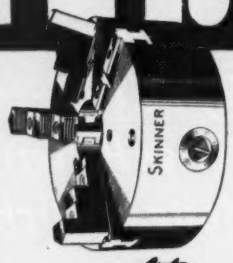
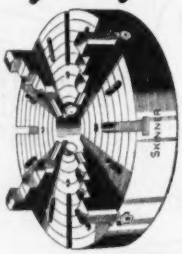
SCROLL CHUCKS Self-centering models for light, medium and heavy duty jobs in tool room or for production runs. Available in sizes from 3" to 18" with semi-steel or forged steel bodies, and heat-treated alloy steel for all other parts. Provided with two sets of solid jaws or two-piece jaws for holding internal or external work. Lands on the jaw, jaw steps and end bites are ground after the chuck is assembled.



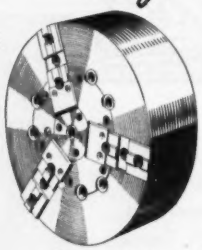
quality

INDEPENDENT CHUCKS Models for medium and heavy duty tool room and general machine shop work. Available in sizes from 4½" to 36" with semi-steel, steel, or forged steel bodies. All other parts are heat-treated alloy steel. Jaws are solid reversible or two-piece with reversible tops for either internal or external gripping. The body surrounds more than 60% of each operating screw for the full length of the screw to assure proper alignment at all times.



accuracy

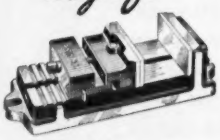
AIR & POWER CHUCKS Self-centering models for heavy duty production work on engine and turret lathes and automatics. Sizes from 6" to 24" with forged steel bodies, and with either 2 or 3 jaws are available. The wedge angle is such that work is gripped positively regardless of jaw position. The chuck will not release the work, even if air line is broken, until operator actuates draw bar. Skinner also has a complete line of power chucking accessories.



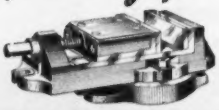
long life

MACHINE VISES Skinner vises are accurate, fast acting and positive gripping. Series DPV wrench-operated Vises have semi-steel body and hardened and ground work holding surfaces. They have all the universal features so necessary for drill press operations. Clamp the work for drilling in one plane — drill — turn the vise on edge for all right angle drilling operations.

Series FS Vises have swivel base for accurate indexing necessary in milling operations. Top of the movable jaw is ground parallel to the base for use as an indicating base for setting cutters, trueing work, etc.



positive grip



Details on the full line of products are included in Skinner General Catalog — write to the company or your nearest Skinner distributor for a free copy!

THE SKINNER CHUCK COMPANY
206 Edgewood Ave., New Britain, Conn.

THE CREST OF QUALITY

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National Twist Drill & Tool Co., Rochester Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

COUNTERSHAFTS

Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Severance Tool Industries, Inc., 636 Iowa Ave., Saginaw, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.

COUNTERS, Revolution

Bristol Co., Platts Mills, Waterbury, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Starrett, The L. S., Co., Athol, Mass.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

COUNTING DEVICES

Starrett, The L. S., Co., Athol, Mass.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

COUPLINGS, Flexible

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

COUPLINGS, Shaft

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling

Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Morgan Engrg. Co., Alliance, Ohio.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

CRANES, Hand Traveling

Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

CUTTER GRINDERS

See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.

CUTTERS, Gear

Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7173 E. McNichols Rd., Detroit 12, Mich.
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National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).

(Continued on page 314)

FOR THOSE TOUGH *Special* JOBS

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National Tool Co.

● **Years of successful experience in *special* tooling and related production problems are yours for the asking. When the job requires *special* cutting tools call in your National Tool Co. representative. He is backed by more than 46 years experience in the engineering and manufacture of *special* cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.**

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precision

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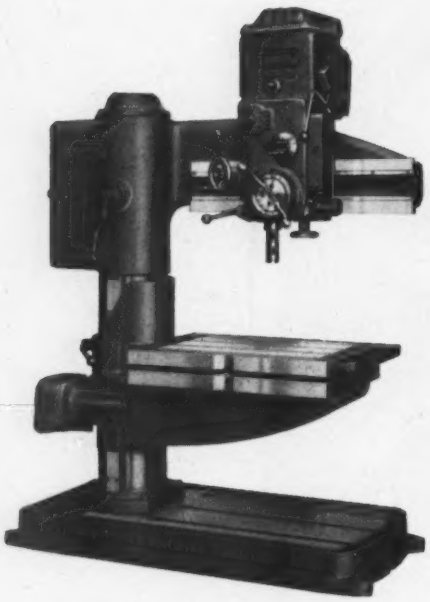


SENSITIVE RADIAL DRILL

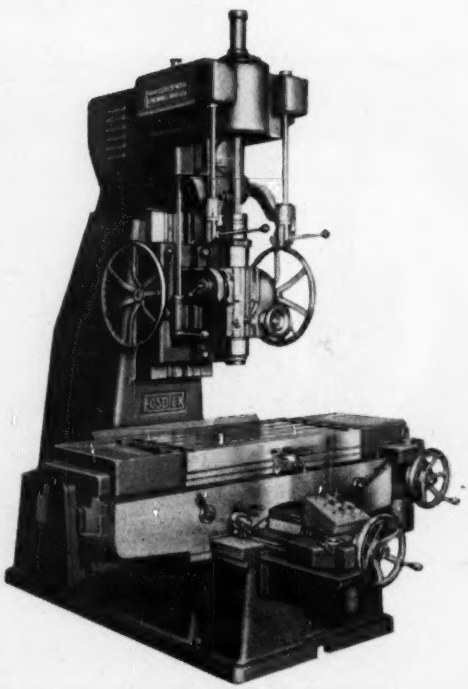
Exclusive with Fosdick, the Sensitive Radial combines upright and sensitive features—rigidity, compactness and convenient table height—with the capacity and flexibility of a radial. Table is universally adjustable, arm rotates at constant height and controls are always within convenient reach. One piece column, 3 and 4 ft. arms. Drills up to 1¼ ".

JIG BORER and AUTOMATIC POSITIONING MACHINE

Jig boring with automatic positioning has eliminated the need for highly-skilled labor for precision hole positioning! With duplicating bars—made quickly, stored easily—the ordinary operator can position table and slide at the same time to within plus or minus .0001" *at the touch of a button!* And Fosdick's Jig Borer costs less than any comparable machine on the market.

Duplicating drilled, bored and tapped parts—*weeks, months* or *years* apart—is fast, economical with Fosdick's Automatic Positioning machine. Set up time measured in minutes! Costly jigs are replaced by compact duplicating bars made of standard ⅝" stock, bored for each hole.

Table sizes: 18"x36" (no automatic positioning) and 22"x44". Table to spindle capacity, 27". 3 hp motor standard, 5 or 7½ hp optional.



ECONOMAX HYDRAULIC RADIAL DRILL

Fosdick was *first* to use hydraulics in a radial for smooth, positive action, easy operation. Controls are grouped around the head for maximum operator efficiency. Hydraulic controls and clamps are interlocked for safety, convenience. Standard equipment includes patented Tool Ejector and built-in fluorescent tube. Thirty-six spindle speeds, eighteen feeds. 3 to 8 ft. arms, 11 to 19 inch columns.

UPRIGHT DRILL

Two sizes, 25″ and 30″ with either round or box columns. Twelve spindle speeds from 60 to 1500 rpm, nine power feeds from .005″ to .043″ per revolution.

SENSITIVE DRILLS

For economical production of small drilled parts. 1 to 6 spindles in either six or nine speeds from as low as 55 rpm to as high as 3600 rpm, four power feeds.

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Please send descriptive bulletins for the following machines:

- ☐ *Sensitive Radial*
- ☐ *Economax Radial*
- ☐ *Jig Borer*
- ☐ *Automatic Positioning Machine*
- ☐ *Sensitive Drill*
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Never Before

SO MANY ADVANTAGES for HIGHEST PRODUCTION

4800 PER HOUR!
3800 PER HOUR!
2500 PER HOUR!

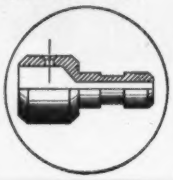
For Top Production

SNOW

FULL UNIVERSAL MACHINES

Air operated, electrically controlled Snow tools are establishing amazing production records daily on a wide variety of work. Just note these typical examples:

DRILLING

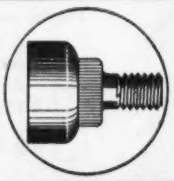


Crossdrill and C'T" Sink 1/16" Hole
Material—Brass
Production—4800 per hour
Fixture—#15 Vertical index
Equipment—#1-UD Drilling Machine

TAPPING

Tap Two #10-32 Holes
Material—Steel stamping
Production—3800 tapped holes per hour
Fixture—#14 horizontal index
Equipment—#1-UT tapping machine

THREADING



3/8"—24 Thread—1/2" Long
Material—Die Cast Aluminum
Production—2500 per hour
Fixture—#10 Drum dial
Equipment—#3-TR Threading machine

Snow air operated—electrically controlled machines have built in full universal controls that allow selection of the type of spindle cycle desired. This feature also permits instant synchronization of the standard Snow Master Fixtures All types of air operated automatic and semi-automatic jigs and fixtures are carried in stock. Standardization permits low cost tooling—and—high production.

Sensitivity of power application prevents tool breakage.

Simplicity of control means that set up and operation can be handled by a less experienced operator with minimum fatigue.

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MANUFACTURING COMPANY
435 Eastern Ave., Bellwood, Illinois
(Chicago Suburb)

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Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co, 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Atrax Co., Newington, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Inc., Springfield, Vt.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Severance Tool Industries, Inc., 636 Iowa Ave., Saginaw, Mich.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
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Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

CUTTERS, Rotary

See Files and Burs, Rotary.

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

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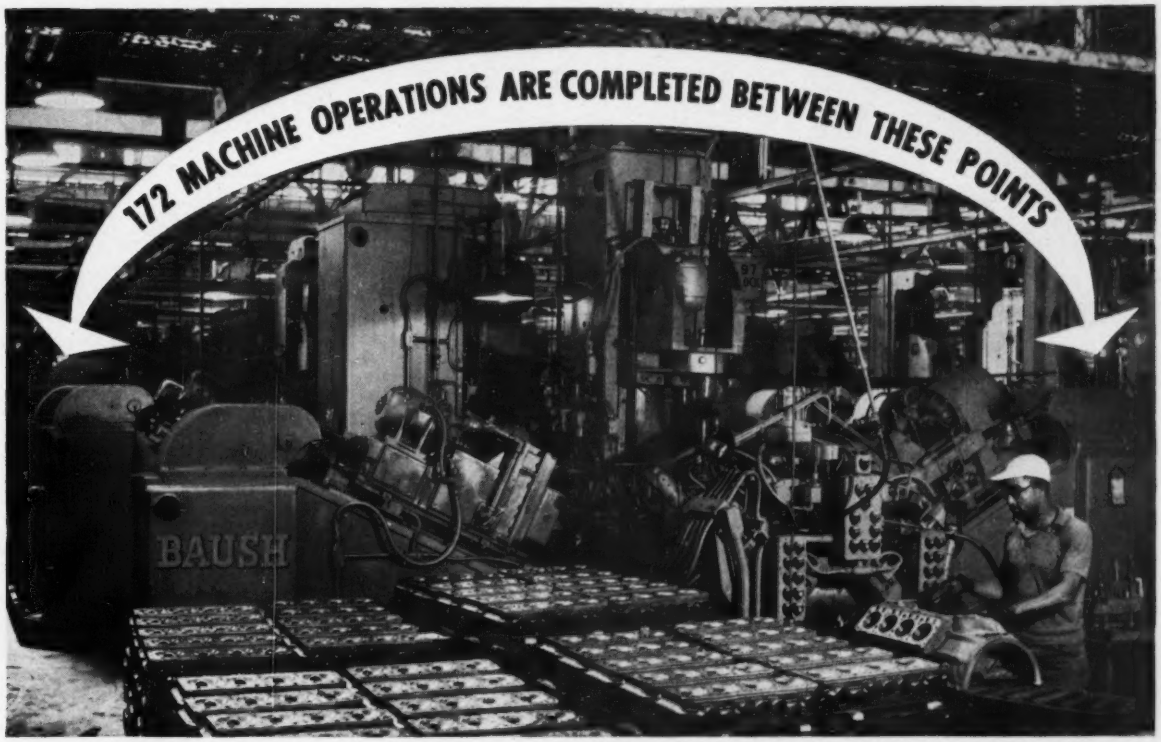
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co, 254 Laurel Ave., Des Plaines, Ill.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 West 50th St., New York, N. Y.
Sinclair Refining Co., 630 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.

(Continued on page 316)

Baush Automatic Transfer Lineups Simplify Multi-Spindle Operations...



Overall view of twin Baush 10-Station Transfer Lineups

With this Baush 10-Station Automatic Transfer, 116 holes, ranging from 3/16" to 2" diam., are drilled on top and bank faces of the V-8 cylinder block of a popular automobile.

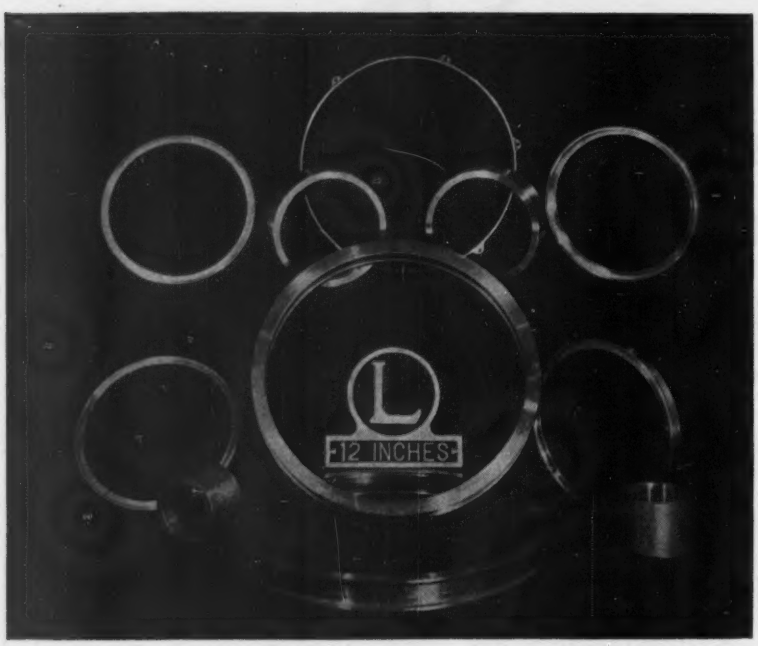
20 of these holes are drilled — sixteen are counterbored, and 20 are chamfered. In all there are 172 operations performed automatically by this one lineup.

SPECIAL FEATURES . . . EXCLUSIVELY BAUSH!

1. Each machine individual.
2. Accurate leveling of one machine to another is unnecessary.
3. Each machine has own electrical controls.
4. Each machine has built-in low pressure hydraulic transfer.
5. Each machine has constant-pressure hydraulic cam clamping.
6. One or more units can be added to lineup for added operations.
7. Exceptionally flexible — 2 lineups can be operated as one.
8. Construction is exceptionally heavy and rugged.
9. Line can be broken to add roll-over fixture to clear chips, automatic indexing, or checking fixture, even after machine has been installed.
10. Years of design experience gives maximum production with minimum maintenance.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

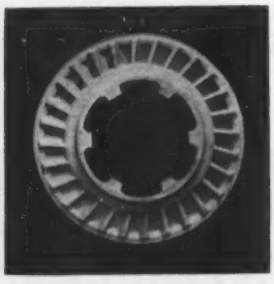
Our many years of designing special automatic multi-spindle machines is yours to use at any time — just drop us a line — tell us your problem, and Baush Engineers are at your service.



to answer the HOT question... specify LEBANON HEAT-RESISTANT Centrifugal Castings

CYLINDRICAL shapes cast in permanent molds by the exclusive Lebanon CENTRI-DIE process, are succeeding where other castings have failed. There are important reasons why Lebanon is able to produce these tough, service-proved castings with such outstanding qualities. First . . . *Lebanon experience*, covering some 41 years, has taught us how to work with difficult-to-cast heat and corrosion alloys. Second . . . *Lebanon testing* involves every proved method (including the use of a million-volt X-Ray machine) to insure absolute structural integrity. Third . . . *Lebanon exclusive processes*, like our CENTRI-DIE method of casting, were developed to give castings superior physical properties, more uniformity and to retain high resistance to many types of destructive agents. For example, today's jet engines which are subject to extremely high temperatures, depend upon Lebanon CENTRI-DIE castings. Lebanon Castings can be made to meet A.I.S.I., A.S.T.M., A.M.S., Army and Navy specifications.

Write for your copy of the Lebanon CENTRI-DIE Bulletin so that you may have, at first hand, all the facts on this important process.



Other Lebanon quality products include centrifugal castings produced in refractory molds—Illustration shows a typical casting made by this process.

LEBANON STEEL FOUNDRY • LEBANON, PA.
"In the Lebanon Valley"

LEBANON ALLOY AND STEEL Castings CIRCLE L

Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Landis Machine Co., Waynesboro, Pa. (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).

CUTTING-OFF MACHINES, Abrasive Wheel

Campbell Mch. Div., American Chain & Cable, 929 Conn. Ave. Bridgeport Conn.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.

CUTTING-OFF MACHINES, Cold Saw

See Sawing Machines, Circular.

CUTTING-OFF MACHINES, Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob Bros., Grafton, Wis.

CUTTING-OFF TOOLS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Luers, J. Milton, 12 Pine St., Mt. Clemens, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

CUTTING-OFF WHEELS, Abrasive

Bay State Abrasive Co., Westboro, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

CYLINDER BORING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Moline Tool Co., 102 20th St., Moline, Ill.

CYLINDERS, Air

Hanna Engineering Works, 1752 Elston Ave., Chicago, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

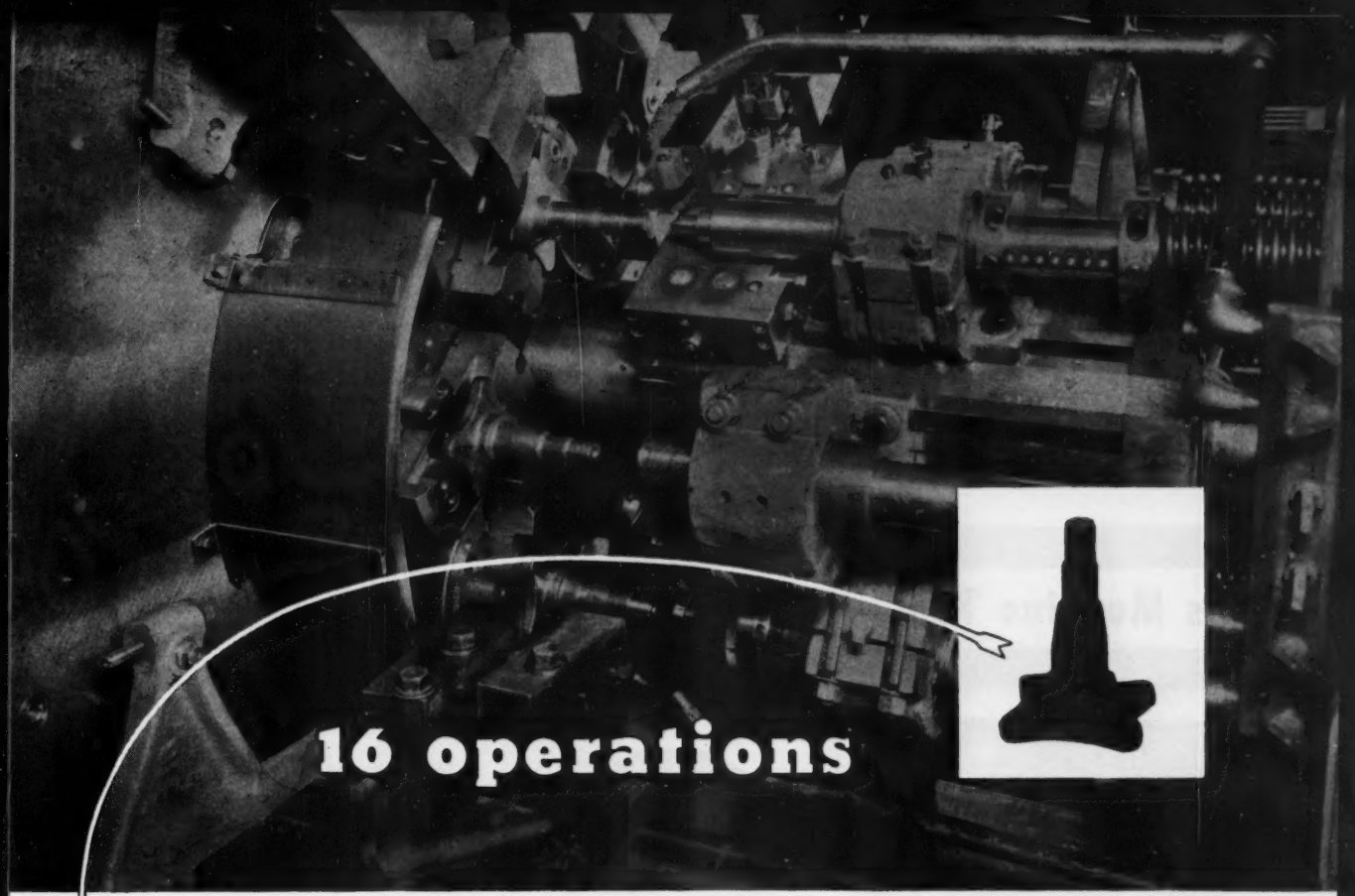
CYLINDERS, Hydraulic

Barnes, John S. Corp., Rockford, Ill.
Hanna Engineering Works, 1752 Elston Ave., Chicago, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., Logansport, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.

DEALERS, Machinery

Botwinik Bros. of Mass., Inc., 14 Sherman St., Worcester, Mass.
Earle Gear & Mch. Co., 4707 Stenton Ave., Wayne Junction, Philadelphia 44, Pa.
Hill-Clarke Machinery Co., 648 W. Washington, Chicago 6, Ill.

(Continued on page 318)



in 16 seconds

on an 8-inch, 6-spindle ACME-GRIDLEY Hydraulic Chucker

When Willys-Overland Motors, Toledo, O. changed methods to cut machining costs on larger production runs of this forged wheel spindle, they didn't buy the machine on general claims. *They bought guaranteed end results—16 operations in 16 seconds.*

They bought a carefully engineered plan of tooling for this particular job—with hydraulic centering loader, unique toolholder combinations for the 16 carbide insert tools, including 5 interrupted cuts on the flange face at 860 S.F.M.

There is another reason—Willys-Overland, like all other big automotive firms, has employed scores of Acme-Gridley Bar Automatics from 10 to 30 years. Based on this experience, it is logical that they seek our advice about advanced practices in tool engineering of Chucking Automatics.

For, no other source offers so much in design and tooling experience on bar and chucking automatics—more than 45,000 machines built.

For end results, cost savings, ask your engineers to contact ours.

JOB FACTS

PART	**Front Wheel Spindle**
SIZE	**8¼" long, 4⅜" swing**
MATERIAL	**Steel forging, AISI-C1040**
OPERATIONS	**16, all with Carbide Tools**
MACHINE TIME	**16 seconds (225 per hr.)**

The NATIONAL ACME COMPANY

170 East 131st Street • Cleveland 8, Ohio.

ACME-GRIDLEY BAR AND CHUCKING AUTOMATICS (1-4-6 AND 8 SPINDLE) • HYDRAULIC THREAD ROLLING MACHINES • AUTOMATIC THREADING DIES AND TAPS • LIMIT, MOTOR STARTER AND CONTROL STATION SWITCHES • SOLENOIDS • CONTRACT MANUFACTURING

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Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Walker, O. S., Inc., Worcester, Mass.

DESIGNERS, Machine and Tool

Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bunell Machine & Tool Co., 1600 East 24th St., Cleveland 14, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Pioneer Engrg. & Mfg. Co., 19679 John R St., Detroit, Mich.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Vinco Corp., 8855 Schaefer Highway, Detroit 27, Mich.

DIAMONDS AND DIAMOND TOOLS

Precision Diamond Tool Co., 102 South Grove Ave., Elgin, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

DIE-CASTING

See Castings, Die.

DIE-CASTING MACHINES

British Industries Corp., International Mchry. Div., 164 Duane St., New York, N. Y.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Kux Machine Co., 3930 W. Harrison St., Chicago, Ill.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.

DIE CUSHIONS

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Dayton Rogers Mfg. Co., 2824 13th Ave., S., Minneapolis 7, Minn.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DIEMAKERS' SUPPLIES

Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Detroit Die Set Corp., 2895A W. Grand Blvd., Detroit 2, Mich.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DIEMAKING MACHINES

Grob Bros., Grafton, Wis.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

DIE SETS, Standard

Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Detroit Die Set Corp., 2895A W. Grand Blvd., Detroit 2, Mich.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Producto Mch. Co., 990 Housatonic Ave. Bridgeport, Conn.
Wales-Strippit Corp., North Tonawanda, N. Y.

DIE-SINKING MACHINES

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.

DIE-SINKING PRESSES

Baldwin-Lima-Hamilton Corp., Philadelphia 42 Pa.
Kearney & Trecker Corp., Milwaukee, Wis.

DIE STOCKS

See Stocks, Die.

DIES, Lettering and Embossing

Bunell Machine & Tool Co., 1600 East 24th St., Cleveland 14, Ohio.
Hoggson & Pettis Mfg. Co., 149 Brewery St., New Haven, Conn.

DIES, Sheet Metal, Etc.

Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Bunell Machine & Tool Co., 1600 East 24th St., Cleveland 14, Ohio.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.

(Continued on page 320)

This Machine Tool
"Feels" It's Way
The Monarch "Air-Gage Tracer" machines different diameters, tapers, bevels, forms, grooves, undercuts, shoulders, necks and chamfers in a single, continuous operation — duplicating the template form within exceedingly close limits. A ROCKFORD Pullmore CLUTCH serves as a brake in the headstock. Let ROCKFORD clutch engineers help your designers develop highly accurate power transmission control for your machines.
ROCKFORD CLUTCH DIVISION
B-W ENGINEERING MAKES IT WORK
B-W PRODUCTION MAKES IT AVAILABLE
ENGINEERING BULLETIN SENT ON REQUEST
ROCKFORD CLUTCHES

FOR BETTER FORGINGS THAT COST LESS

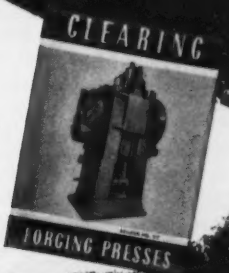
Although they demand less skill and less manual effort from the operator, Clearing forging presses turn out more pieces per hour than old-fashioned methods. The forgings are uniform in size and weight regardless of the human element.

If you're looking for ways to reduce forging costs or increase production without increasing man-hours, Clearing forging presses are your answer. We'll be glad to supply details without obligation to you.

CLEARING MACHINE CORPORATION

6496 WEST 65TH STREET • CHICAGO 38, ILLINOIS

HAMILTON DIVISION—HAMILTON, OHIO



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Cut-away illustrations show why Clearing forging presses give long, dependable service on the tough jobs. Ask for your free copy.

CLEARING PRESSES THE WAY TO EFFICIENT MASS PRODUCTION

VISIBLE and PROTECTED

ALL ELECTRIC CONTROLS

Another EXCLUSIVE FEATURE *of*

REID GRINDERS

Reid had the worker in mind when this feature was incorporated. *Instantly accessible, always visible, constantly protected;* a transparent shatter-proof panel cover keeps out dust and prevents accidental contact. This forward-looking design feature simplifies inspection and adjustment when necessary. (Full J.I.C. controls available for all models)

Every feature of the Model 618-V is made functional by Reid's constant effort to increase precision while simplifying an essential machine tool for easier operation, and improved output.

CAPACITY: 6" x 18" x 15¼"
WORK TABLE: 51" x 8"
POWER FEED, TABLE: 12-35 ft./min.
STANDARD WHEEL: 7" x ½" x 1¼"
FLOOR SPACE: 70" x 36"
WEIGHT: 2,000 lbs., crated 2,225 lbs.

For more features *of value to you,* write for Bulletin 618-2.

Reid Brothers Company, Inc.

BEVERLY, MASSACHUSETTS

Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Jahn, B., Manufacturing Co., Ellis St., New Britain, Conn.
Metal Carbides Corp., Youngstown, Ohio.
Niagara Mch. & Tool Wks., 683 Northland Ave., Buffalo, N. Y.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit Corp., North Tonawanda, N. Y.
Waltham Mch. Wks., Newton St., Waltham, Mass.

DIES, Threading

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Mansfield, Mass.
Detroit Tap & Tool Co., Detroit, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

DIES, Threading, Opening

Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

DIES, Thread Rolling

Detroit Tap & Tool Co., Detroit, Mich.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

DISCS, Abrasives

Besly-Welles Corp., Beloit, Wis.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

DIVIDING HEADS

See Indexing and Spacing Equipment.

DOWEL PINS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave,. Chicago 50, Ill.
Detroit Die Set Corp., 2895A W. Grand Blvd., Detroit 2, Mich.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRAFTING MACHINES

Universal Drafting Mch. Corp., 7960 Lorain Ave., Cleveland, Ohio.

DRESSERS, Grinding Wheel

Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.

(Continued on page 322)

STANDARD CARBIDE MILLING CUTTERS

From The World's Most Complete Stock of Standard Carbide Tools

STC

Ask for catalog listing all Super Standard Carbide Tools.

QUALITY CARBIDE TOOLS

Super TOOL COMPANY

21650 Hoover Road, Detroit 13, Michigan also 5210 San Fernando Rd., Glendale 3, California

WHEN

your gear specifications are tough do as others do—

Leave it to

because:

Perkins *custom-made* **Gears** *are made by an organization which has specialized in this field for over 30 years—a company you'll like to do business with!*

PERKINS MAKES: bevel gears, ratchets, ground thread worms, spiral gears, worm gears, helical gears, spur gears with shaved or ground teeth.

NOTE: A new product—the PERKINS PRECISION SPRING COILER. This patented coiler turns out precision springs—any type, shape, size from wire sizes .005 to .125. Complete data and prices upon request.

Erickson Tools Div., Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hoglund Engrg. & Mfg. Co., Inc., Berkeley Heights, N. J.
Metal Carbides Corp., Youngstown, Ohio.
Meyers, W. F., Co., Bedford, Ind.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.

DRIFTS, Drill

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.

DRILL HEADS, Multiple Spindle

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Commander Mfg. Co., 4233 W. Kinzie St., Chicago 4, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Commander Mfg. Co., 4233 W. Kinzie St., Chicago 4, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

DRILL SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.

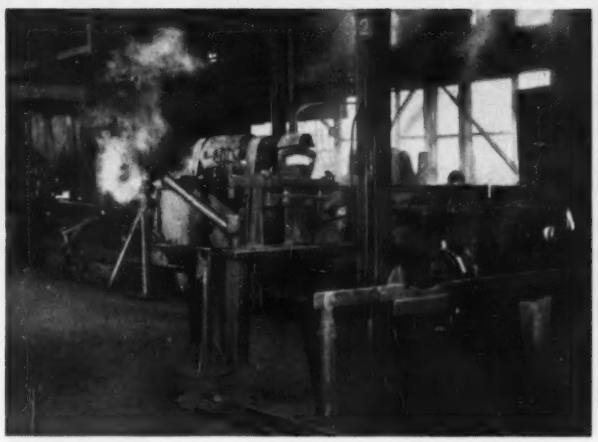
DRILL STANDS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.

DRILLING ATTACHMENTS, Chip Breaker Type

Commander Mfg. Co., 4233 W. Kinzie St., Chicago 4, Ill.

(Continued on page 324)



OILGEAR DRIVES ON GLAMORGAN CENTRIFUGAL PIPE CASTING MACHINE

Something more than 5 years ago, the Glamorgan Pipe & Foundry Company, of Lynchburg, Va., a leading manufacturer of cast iron pipe, designed its own centrifugal pipe casting machine, using Oilgear Fluid Power equipment to tilt the ladle and move the casting carriage.

The degree of control over pouring rate and carriage travel afforded by Oilgear has had almost unbelievable results. Scrap caused by irregularities in moving parts has become negligible. Weight controls are well within the close limits set by Industry specifications. Only 3 men are needed to operate the equipment. Despite the fact the machine has averaged 500 operations per day since 1948, maintenance on Oilgear equipment has totaled less than $200.00. The fumes and dirt necessarily present in foundry operations have had no effect on Oilgear fluid power equipment.

TYPICAL OF OILGEAR'S ABILITY TO SOLVE MACHINE DESIGN PROBLEMS

Sure it takes power to tilt a ladle and move a pipe casting machine carriage. But above all, it takes absolute and precise control of the speed of pouring and the speed of carriage travel if the product is to be perfect and uniform.

It not only takes power but power under control to print in register on flimsy cellophane at high speed, to set up paper piles for repetitive serial cuts to hairline register automatically, to cut fish on a continuous conveyor to accurate weight for canning, to vary the speed of a large beater automatically to conform sensitively to the changing viscosity of the mass.

These are all triumphs of Oilgear Fluid Power—where this flexible, controllable, versatile power leads the way to better machine design or to the solution of hitherto unsolved problems.

Think of Oilgear Fluid Power as identical with electrical power . . . generated by a pump . . . applied over conductors through a motor or motor element. But Oilgear Fluid Power can be converted into linear movement as well as rotary; can be exerted statically, without motion; can be varied infinitely, steplessly without additional equipment.

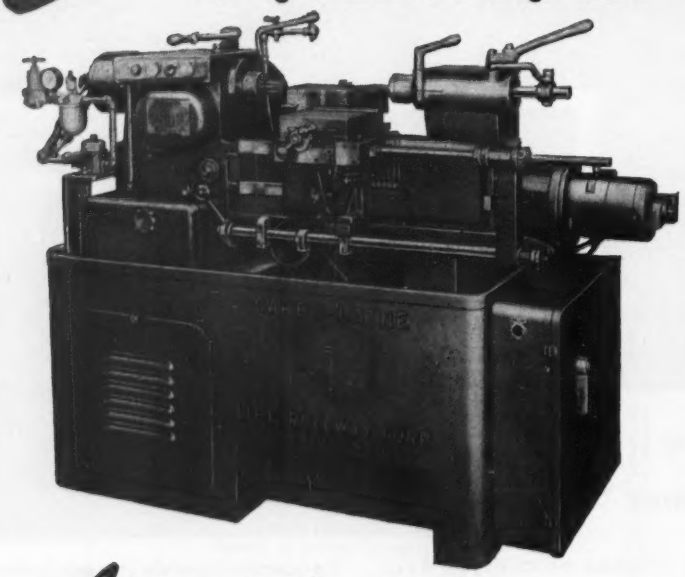
And the unique Oilgear design is oil hydraulic design at its simplest and best. It is generally accepted as the leader in its field. It will cost you nothing to see what Oilgear can do to improve the salability of your equipment . . . may profit you and your users in an amazing degree. THE OILGEAR COMPANY, 1569 W. Pierce St., Milwaukee 4, Wisconsin.

OILGEAR

OILGEAR

STAMINA

take heavy, high-speed cuts on high-Brinell and tough steels



Lipe Carbo-Lathe

America's pioneer carbide tool lathe with complete cycle electrically controlled

Bed and headstock cast in one piece from 500 pounds of chrome-molybdenum iron! Massive tailstock with a 3" diameter quill! Heavy bed sidewalls reinforced by cross ribs! These are the reasons why the Lipe Carbo-Lathe eliminates all deflection and weaving—why it is rigidly resistant to torsional stresses and strains. Brute power and a wide range of selective speeds permit hogging feeds and cuts on high-Brinell steels, scaly surfaces, weld spots and jump cuts.

More, the complete cycle can be electrically controlled. A push on the starter button starts the spindle, moves the carriage to the cutting position, automatically engages the mechanical feed. At the end of the cut, the feed disengages, the spindle stops and the carriage returns quickly to the loading position. At every point in the cycle the operator has complete manual control, if necessary.

Lipe Carbo-Lathes are sold with or without Automatic Electric Cycle Attachment (illustrated). Write for further information and delivery dates.

LIPE ROLLWAY — *Lipe*-ROLLWAY CORPORATION
Manufacturers of Automotive Clutches and Machine Tools
Syracuse 1, N. Y.

DRILLING MACHINES, Automatic

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave, Bellwood, Ill.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Wales-Strippit Corp., North Tonawanda, N. Y.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Bench

Atlas Press Co., 1253 No. Pitcher St., Kalamazoo, Mich.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Dumore Co., 1300 17th St., Racine, Wis.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

DRILLING MACHINES, Boiler

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.

DRILLING MACHINES, Deep Hole

Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Wales-Strippit Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Gang

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St, Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

(Continued on page 326)

another reason why more threading shops say—

"we've standardized on VERS-O-TOOL"

You probably know Vers-o-tools as the self-opening, precision die heads that feature the circular-ground thread type of chaser—

- **the kind that give as many as 200 grinds.**
- **the kind that are micrometer gauge checked on their blocks before and after each grind, so that the first piece cut will be right—no removal of head, no fussing to get size, no scrap.**

Vers-o-tools are the most versatile tools, produce more per dollar of investment—cost less. That's why so many experienced users say, "We've standardized."

How about the shorter runs?
Simply substitute the Adjustable Blade Chasers and Blocks for circulars in the same Vers-o-tool head. They also have ground threads and the cost is less.

Hollow Milling?
End forming and turning cutters, both circular and blade-types, cut three times faster than single point tools, snap open and leave no marks, also knurls and burnishing rolls.

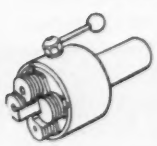
Interchangeable?
All chasers, mills or rolls, circular or blade-type, are, with their blocks, used in both revolving and non-revolving Vers-o-tools, die size for size.

DT-52 is the complete new catalog on Vers-o-tools and Namco Solid and Collapsible Taps.

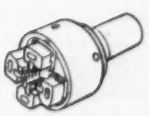
Time Saving... that's it!

Change chasers in less than 2 minutes—just lift reset handle, slide back the hood and they drop out—no screws, no adjustments, patented.

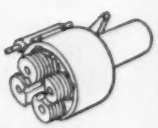
Time saving—that's it! . . . And that's one big reason why makers of smooth class 3 high pressure threads whose 'round-the-clock schedules often run into millions of a kind STANDARDIZE on Namco Vers-o-tools.



Style DS Vers-o-tool (Non-revolving Type) 10 Sizes, ⅜"—6½".



Style DR Vers-o-tool (Revolving Type) 13 Sizes ⅛"—6½" Shown with Adjustable Blade Chasers 7 Sizes, ⅜"—2".



Style DBS Vers-o-tool (for B&S Automatics) 3 Sizes, ⅛"—⅝".

24-HOUR DELIVERIES ON MOST STANDARD STOCKABLE NC AND NF CHASERS AND BLOCKS—ALSO NATIONAL TAPER PIPE AND DRY SEAL

The NATIONAL ACME CO.

170 EAST 131 STREET, CLEVELAND 8, OHIO.

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • Limit, Motor Starter and Control Station Switches • Solenoids • Contract Manufacturing.

Westinghouse...aided by MICRO... brings new efficiency to automatic gear hardening

MICRO roller arm actuated switch chosen by Westinghouse engineers. Seal boot covers plunger and gasketed bottom plate protects enclosed switch from dirt, dust and splash of oil or water.

So speedy and efficient is this Westinghouse INDUCTALL gear hardening machine that a battery of five of them is capable of heat-treating up to 300 gears an hour.

For automatic control of the vital handling, heating, quenching and unloading, Westinghouse selected four MICRO precision switches. This selection was prompted by their precise, long-life, trouble-free performance, ease of mounting and water-tight connections provided.

Choice of MICRO switches as components for this rugged machine tool is typical of the confidence placed in MICRO design and performance by design engineers throughout the machine tool industry.

MICRO field engineers, with wide experience in the switch requirements of machine tool design, are located near you. They are ready and willing to assist in the selection of the MICRO switch best suited to your specific requirements . . . or help in the development of an entirely new switch if this is indicated. Write or call your nearest MICRO branch office.

Westinghouse engineer points to one of four MICRO precision switches which are operated by cams to provide completely automatic operation of the handling, heating, quenching and unloading of gears in the Westinghouse INDUCTALL gear hardening machine.

Exterior view of Westinghouse INDUCTALL gear hardening machine which shows the clean, compact design of this modern machine tool for mass-production gear hardening.

MICRO MAKERS OF PRECISION SWITCHES
FREEPORT, ILLINOIS
A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

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Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St, Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DRILLING MACHINES, Horizontal Portable

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

DRILLING MACHINES, Inverted

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.

DRILLING MACHINES, Multiple Center Column Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.

DRILLING MACHINES, Multiple Spindle

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

(Continued on page 328)

If you've never used this—

maybe you should

It's UNIFLEX...

The new Helically-corrugated Seamless Flexible Tube

If you have a process or application involving flexible metal hose, it will pay you to know a few facts about UNIFLEX. For this entirely new, *seamless* flexible tubing is just coming into its own—in applications too critical for ordinary concentric tubing.

Consider . . .

1. We make UNIFLEX from seamless, special bronze alloy tube—tough, corrosion-resistant, leak-proof.

2. Helical corrugations give UNIFLEX greater flexibility and longer life. Our unique method of manufacture eliminates embrittlement resulting from excessive work-hardening.

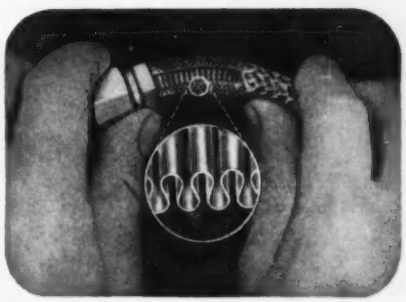
3. For leakless service, UNIFLEX fittings have metal-to-metal seat. Seal is produced through spring washer effect of hose on fitting body.

4. Unlike conventional split-ring collars used on concentric tubing, the *one-piece* UNIFLEX collar hugs 4 or 5 convolutions. This means far less wear —and much greater strength in the connection.

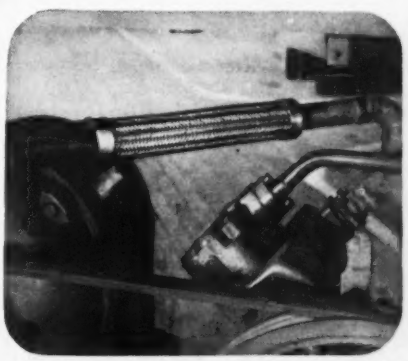
5. UNIFLEX is encased in high-tensile bronze wire braid attached to specially designed couplings. Hose is relieved of damaging strains; sheath prevents elongation, gives extra safety, withstands abrasion.

6. UNIFLEX helical construction distributes flexing between inner and outer surfaces of convolutions —eliminates strain usually limited to one groove. Result: Greater safety and longer life.

7. UNIFLEX fittings are shorter and more compact than most others. This permits the use of more hose length and less fitting length—gives far greater maneuverability, makes it easier to get in and out of tight places.



Note the Helically-corrugated, seamless wall structure of UNIFLEX.



UNIFLEX vibration eliminator used between circulating coils and compressor of a General Electric air conditioning unit. Motor-compressor unit is spring-mounted, requires a flexible connection.

UNIFLEX is supplied in measured lengths, properly fitted and ready for use. You can buy it in sizes from ¼" to 6" ID. It has already proved itself in such applications as hydraulic lines, oil burners, refrigeration machinery, air conditioning equipment, pumps, compressors, diesel engines and machine tools. Our Designers and Engineers have a thorough knowledge of its behavior under exacting conditions. If you'd like to know what UNIFLEX can do for *you* write us about your problem. We'll be glad to help you—without obligation.

Send for your free copy of our new UNIFLEX Catalog. It contains full technical data, sizes, fittings, suggestions for use, and information about new UNIFLEX Quick-soldered Couplings.

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SAVE MACHINE TIME . . . MONEY . . . USING JOHNSON UNIVERSAL BRONZE

THESE bronze bars have many uses, particularly where their free machining properties are important. Many manufacturers find Johnson Universal Bronze ideal for certain gears and pinions, guide rollers, sheaves, trolley wheels, tips for air tools, washers, thrust plates, as well as for bushings and bearings. The cost per pound is offset many times by the low cost of machining. Non-sparking properties and corrosion resistance recommend it for certain uses. Another big advantage is that Johnson Universal Bronze is available from distributors' stocks, fully machined, in solid bars ⅝" to 8" diameters and in cored bars from ½" to 7¾" inside diameters—in all, over 400 sizes. Also available in hexagon bars from ⅝" to 3" outside diameters. Each bar is usable from end to end, no waste.

JOHNSON BRONZE CO.
520 So. Mill St.
New Castle, Pa.

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Sleeve Type

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
British Industries Corp., International Mchry. Div., 164 Duane St., New York, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLING MACHINES, Rail

See Drilling Machines, Gang.

DRILLING MACHINES, Sensitive

Atlas Press Co., 1253 No. Pitcher St., Kalamazoo, Mich.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippit Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Upright

Atlas Press Co., 1253 No. Pitcher St., Kalamazoo, Mich.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Neise, Karl A., Dept. M, 381 Fourth Ave., New York 16, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippit Corp., North Tonawanda, N. Y.

(Continued on page 330)

Pressure Processing

. . . whoever uses it in their production is a customer or potential customer of **H-P-M**

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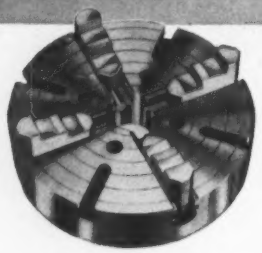
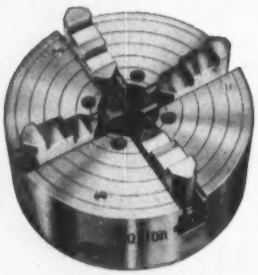
Presses for Every Pressure Processing Application

HORTON CHUCKS



quality

performance



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See your Horton Distributor for a complete line of standard chucks and specials for every application.

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THE E. HORTON & SON CO.

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Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS, Center

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

DRILLS, Core

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Erickson Tools Div., Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DRILLS, Deep Hole

Pratt & Whitney, West Hartford 1, Conn.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Mass.

DRILLS, Portable Electric

Black & Decker Mfg. Co., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Dumore Co., 1300 17th St., Racine, Wis.
Millers Falls Co., Greenfield, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Skil Corp., 5039 Elston Ave., Chicago, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

DRILLS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

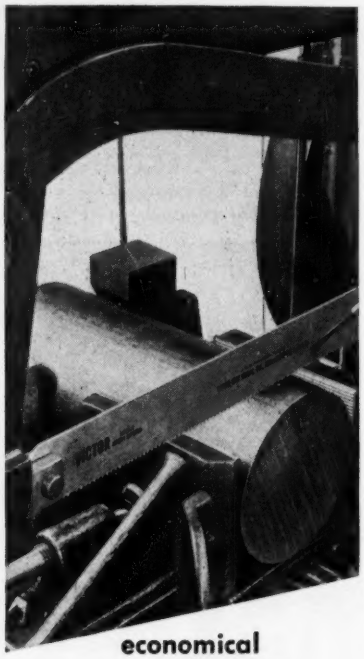
DRILLS, Ratchet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.

DRILLS, Twist

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.

(Continued on page 334)



economical metal cutting with

VICTOR "Moly" HIGH SPEED Power BLADES

Whatever your metal cutting problem, VICTOR "Moly"® High Speed Power Blades will cut your initial blade cost 15%, and give you the additional economy of more efficient cutting.

Quality makes VICTOR Blades industry's preference—top-quality, carefully heat-treated steel, fabricated on specially designed equipment, to give you fast, economical cutting and long blade life. Send for the free VICTOR Metal Cutting Booklet which tells you how to pick 'em—Gold "Moly"® High Speed or Silver Unbreakable High Speed.

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VICTOR "Moly"® High Speed Power Blades are always sold through the recognized Industrial Distributor because he is closest to your problems. You know and have confidence in him, and he can give you delivery from stock where and when you want it.

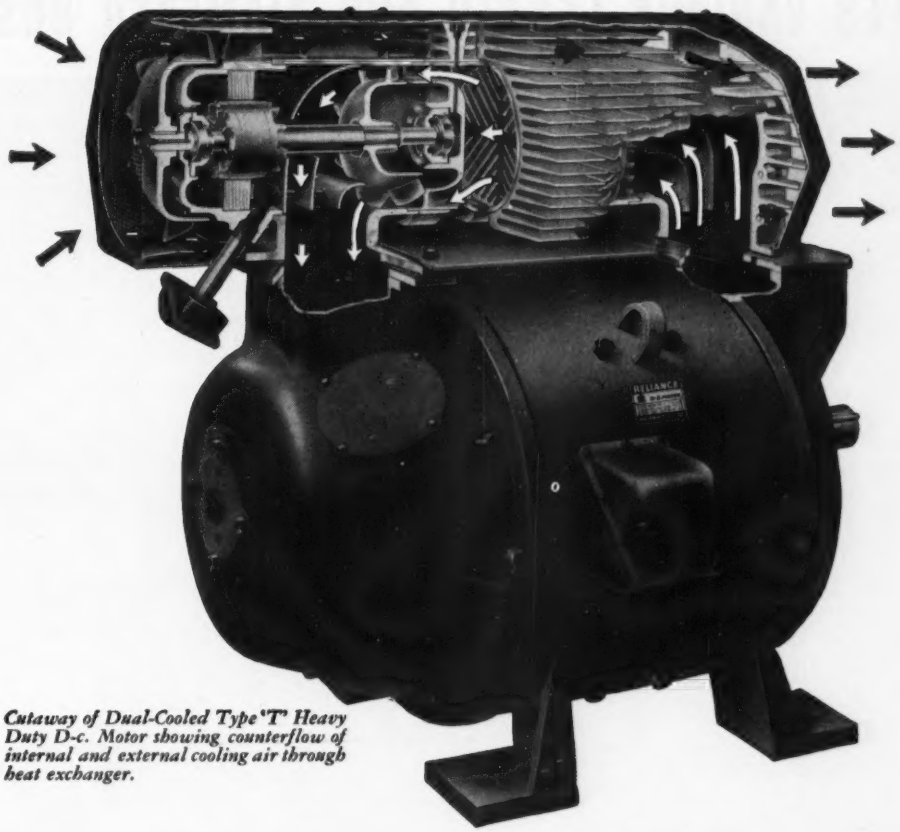
1822 VICTOR

SAW WORKS, INC. • MIDDLETOWN, N.Y., U.S.A.

Makers of Hand and Power Hack Saw Blades, Frames and Metal Cutting Band Saw Blades

RELIANCE *Totally-Enclosed* *Dual-Cooled* D-C. MOTORS

PATENT APPLIED FOR



Cutaway of Dual-Cooled Type 'T' Heavy Duty D-c. Motor showing counterflow of internal and external cooling air through heat exchanger.

for Wider Speed Ranges... Higher Ratings

New Reliance Dual-Cooled Motors provide dependable totally-enclosed, fan-cooled operation over wider speed ranges and higher ratings than were ever before possible . . . and this is accomplished with floor-space savings of up to 30%!

Dual-Cooled Motors are completely enclosed... have two separate cooling systems operating independently of the motor speed. One system circulates high-velocity air within the motor, that is cooled in the finned inner duct of the heat exchanger. This heat is dissipated in the other system by air sweeping through the fins of the outer duct.

The Dual-Cooled Motor is especially adaptable to Reliance adjustable-voltage V•S Drive and is available in ratings from 15 through 150 horsepower. Explosion-proof Dual-Cooled Motors are available through 100 hp., in conformity with Underwriters and Bureau of Mines specifications.

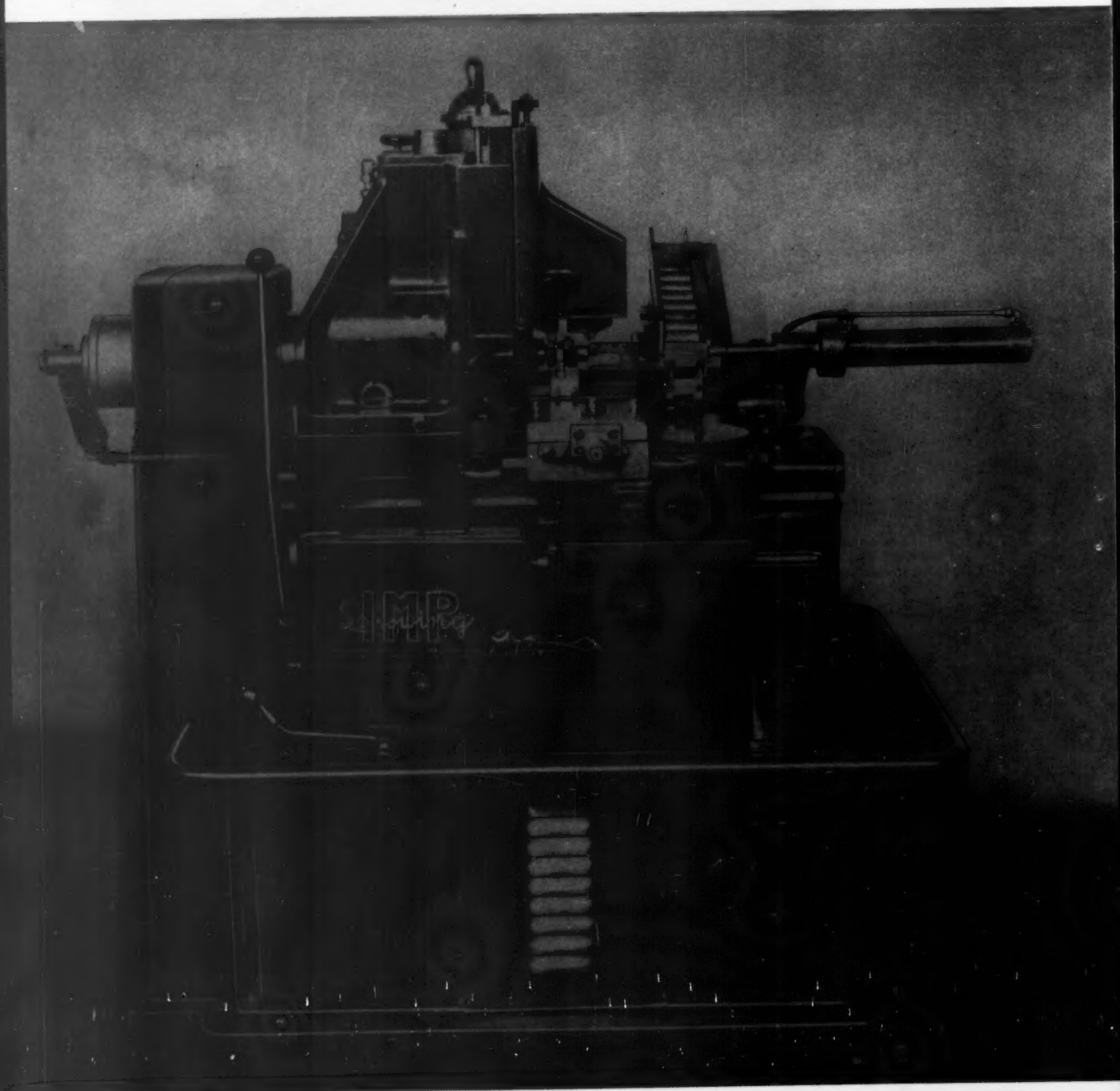
Whatever your application . . . get further details from the nearest Reliance Sales Office . . . or write for Bulletin C-2201.

RELIANCE ELECTRIC AND ENGINEERING CO.

1077 Ivanhoe Road, Cleveland 10, Ohio • Sales Representatives in Principal Cities

MACHINE OF

AUTOMATICALLY-LOADED *Lo-swing* IMP
HANDLES VARIOUS LENGTH AND DIAMETER BUSHINGS



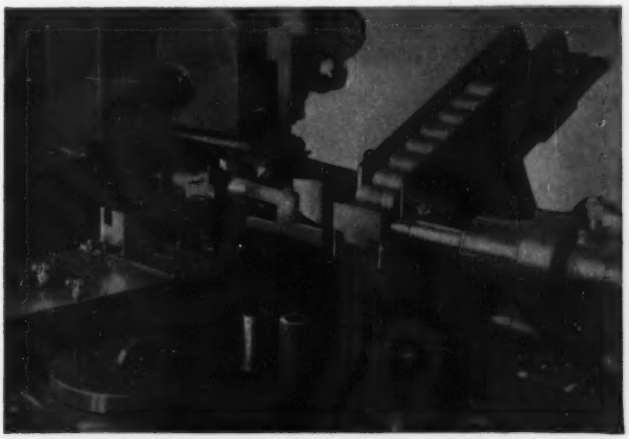
PRODUCTION COSTS

THE MONTH

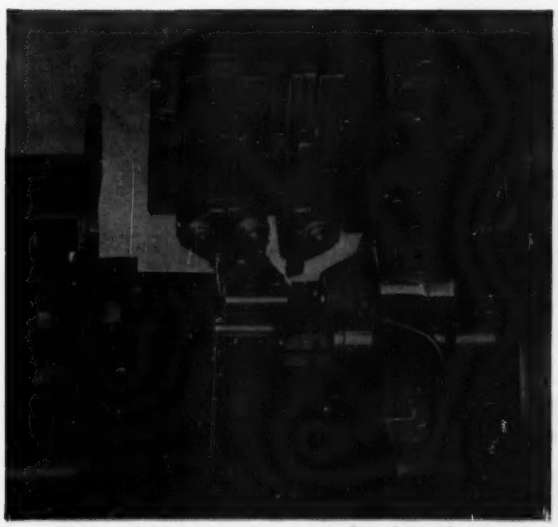
PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK

Problem: Turning and facing *both* ends of a variety of bronze bushings on automatically loaded lathe. Bushings to vary in length and diameter, and to come to machine rough cast with hole broached.

Solution: Bushings are loaded onto an expanding arbor by a plunger which picks up the bottom bushing from the inclined chute shown in illustration at the right. A movable stop locates the bushing on the arbor and then withdraws to allow tools on the Third Slide (see lower illustration) to face *both* ends of the bushing to length. Simultaneously, the Front carriage tool turns the O. D. A stripper kicks the finished bushing off the arbor and into the unloading chute while tools are returning to starting position.



Above: Close-up view from front of machine showing Loader Chute and Loading Plunger.



Above: Close-up view from rear of machine, showing Movable Stop and clear view of tooling.

When bushings of another diameter are to be turned, ease and quickness in change-over are provided. The operator merely changes the arbor loading plug, makes a quick adjustment to take care of longitudinal tool travel, and resets the tools. If there is sufficient change in bushing diameter to necessitate a different spindle speed, a change of easily-accessible pick-off pulleys makes this a simple operation. The loader chute is made adjustable to accommodate various bushing lengths and diameters.

The Lo-swing IMP worked out very well on this job due to the availability of the Third Slide for the facing operations, thus leaving the rear of the machine open for loading and unloading. Tungsten Carbide Tools were used on this job with speeds and feeds set accordingly. Other inherent IMP features, such as rigidity, accuracy at high speeds, and ease of change-over contributed also in large measure to the satisfactory solution of the job.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

ARE LOWER WITH Lo-swing

DRILLS, Wire
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.

DRIVES, Chain
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

DUPLICATORS
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois, Detroit, Mich.

DUST COLLECTORS
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Pangborn Corp., Hagerstown, Md.
Torit Mfg. Co., 307 Walnut St., St. Paul 2, Minn.

DUST CONTROL SYSTEMS
American Air Filter Co., Inc., Louisville, Ky.
Leiman Bros., Inc., 156 Christie St., Newark, N. J.
Pangborn Corp., Hagerstown, Md.
Torit Mfg Co., 307 Walnut St., St. Paul 2, Minn.

ELECTRICAL EQUIPMENT
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

EMERY WHEEL DRESSERS
See Dressers, Grinding Wheel.

EMERY WHEELS
See Grinding Wheels.

For machine screws, wood screws, drive screws, specials, etc. These machines have automatic feed and self-lubrication. They feature accuracy, easy setup, rigidity and table-top working level. Model A-312 rolls screws from .138 through ⅜" diameter with thread lengths up to 2½". Smaller model A-190 rolls from .086 through .190 inches diameter with thread length up to 1½".

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SUPER-SPACERS
HARTFORD Special
THE HARTFORD SPECIAL MACHINERY CO., HARTFORD 12, CONN.

ENGRAVING MACHINES
British Industries Corp., International Mchry. Div., 164 Duane St., New York.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.

EXTRACTORS, Screw
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Union Twist Drill Co., Athol, Mass.

FACING MACHINES
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.

FANS, Exhaust, Electric Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
General Electric Co., Schenectady 5, N. Y.

FEEDS FOR PRESSES, Automatic
Federal Press Co., 600 Division and Big Four R. R., Elkhart, Ind.
Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.

FELT, For All Applications
American Felt Co., Glenville, Conn.

FILES, Hack
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Heller Bros. Co., Newcomerstown, Ohio.
Nicholson File Co., 23 Acorn St., Providence, R. I.
Severance Tool Industries, Inc., 636 Iowa Ave., Saginaw, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

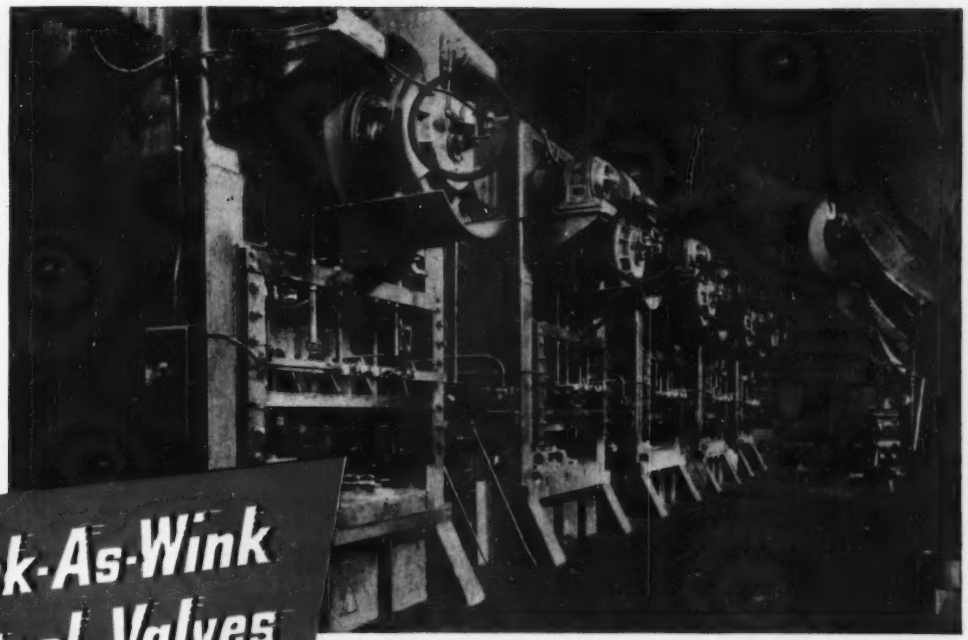
FILES, Machine
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILES AND BURS, Rotary
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jarvis, Chas. L., Co., Middletown, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Severance Tool Industries, Inc., 636 Iowa Ave., Saginaw, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES, Dies, Etc.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Grob Bros., Grafton, Wis.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Jarvis, Chas. L., Co., Middletown, Conn.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

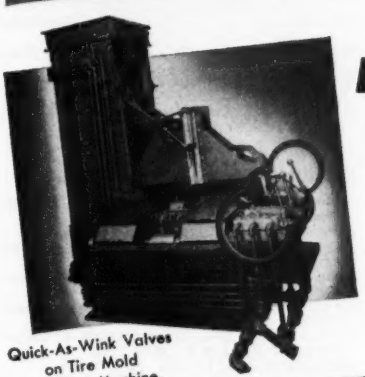
FILTERS, Air
American Air Filter Co., Inc., Louisville, Ky.

FILTERS, Coolant and Oil
Bowser, Inc., 1365 E. Creighton Ave., Fort Wayne, Ind.
Cuno Engrg. Corp., Meriden, Conn.
(Continued on page 336)

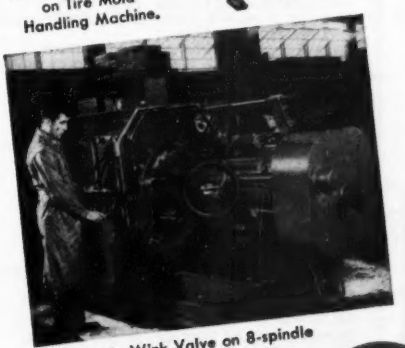


Quick-As-Wink Control Valves

Quick-As-Wink Solenoid Air Valves on Battery of Heavy Duty Presses.



Quick-As-Wink Valves on Tire Mold Handling Machine.



Quick-As-Wink Valve on 8-spindle Automatic Chucking Machine.

proven dependable performance that keeps you out of "post-mortems"

● The easiest and surest way of preventing break-downs, repair costs, material spoilage, machine damage, operator injury, lost production, customer ill-will — and their "post-mortems", is to install Quick-As-Wink Valves on *all* your air and hydraulic controls.

Positive and fast acting, every valve is designed and built to meet the most exacting requirements and individually tested before being shipped. All operating parts are in pressure balance eliminating any tendency to creep or crawl. Danger of "repeating"— major cause of accidents, break-downs and other trouble — is practically eliminated. Most foremen and superintendents know there's nothing better, for long, dependable, trouble-free service than Quick-As-Wink Control Valves. Can you afford to gamble with less?

Quick-As-Wink
AIR AND HYDRAULIC
Control Valves

Hand, Foot, Cam, Diaphragm and Solenoid Operated

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See Couplings, Flexible.

FLEXIBLE SHAFT EQUIPMENT
Dumore Co., 1300 17th St., Racine, Wis.
Jarvis, Chas. L., Co., Middletown, Conn.
Neise, Karl A., Dept. M, 381 Fourth Ave., New York 16, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

FORGING (Upsetting) MACHINES
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

FORGINGS, Drop
Bethlehem Steel Co., Bethlehem, Pa.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow Bored
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel
Bethlehem Steel Co., Bethlehem, Pa.
Morgan Engrg. Co., Alliance, Ohio.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Upset
Bethlehem Steel Co., Bethlehem, Pa.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING AND BENDING MACHINES
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Columbia Machinery & Engineering Corp., Hamilton 1, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Calif. (Stretch-Wrap).
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

FORMING AND STAMPING MAC NES
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.

FORMING TOOLS or Tool Blanks
Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bunell Machine & Tool Co., 1600 East 24th St., Cleveland 14, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

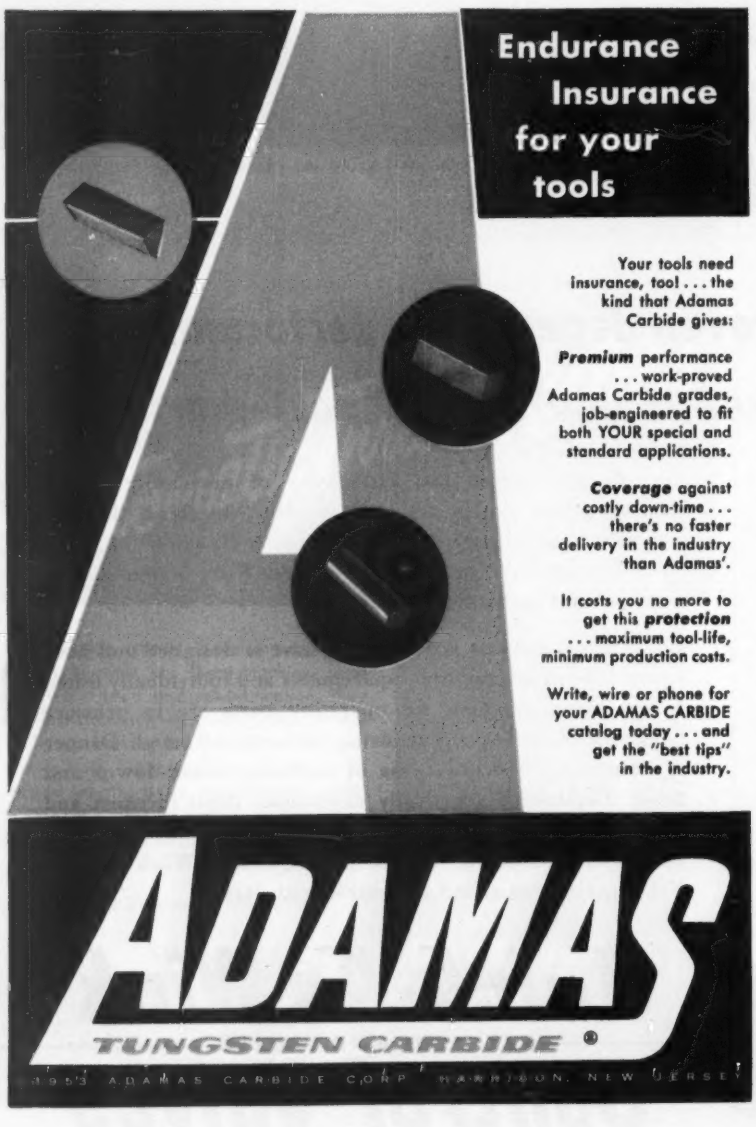
FRAMES, Machinery Welded
Bunell Machine & Tool Co., 1600 East 24th St., Cleveland 14, Ohio.
Mahon, R. H., Co., Detroit 34, Mich.

FURNACES, Heat-Treating
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

FURNITURE, Shop
Standard Pressed Steel Co, Jenkintown, Pa.

GAGE BLOCKS
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St, New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Watham St., Watertown, Boston, Mass.
Webber Gage Co., 12909 Triskett Rd., Cleveland 11, Ohio.

(Continued on page 338)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TUNGSTEN CARBIDE ®
1953 ADAMAS CARBIDE CORP. HARRISON, NEW JERSEY

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1. Keeps oil and grease in

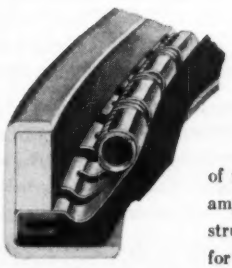
2. Keeps dust, dirt and water out

Bearings *last longer* and require *less maintenance* when they're protected by Garlock KLOZURE Oil Seals. These superior oil and grease seals keep the lubricant sealed *in*—keep dirt and contaminating materials locked *out*.

Garlock KLOZURES are produced in a wide range of sizes including Metric to fit standard International Millimeter ball and roller bearing housings. *For complete information write for Klozure Catalog No. 10.*

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

Specially Designed KLOZURE Oil Seals



For those applications for which none of our regular KLOZURE models are suitable we design and manufacture oil seals of many special types. Examples of such special constructions are . . . small seals for needle bearings . . . seals for self-aligning or spherical bearings . . . and heavy duty seals as illustrated at the left for steel mill roll necks or other shafts of large diameter. If you have a bearing seal problem let our experienced technical staff solve it for you.

*Registered Trademark

GARLOCK
Klozure*
Oil Seals
For all types of bearings

GAGES, Air

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GAGES, Comparator

Ames, B. C., Co., Waltham 54, Mass.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Neise, Karl A., Dept. M, 381 Fourth Ave., New York 16, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Depth

Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Homestrand, Inc., Larchmont, N. Y.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Dial

Ames, B. C., Co., Waltham 54, Mass.
Bristol Co., Platts Mills, Waterbury, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Homestrand, Inc., Larchmont, N. Y.
Neise, Karl A., Dept. M, 381 Fourth Ave., New York 16, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Electric

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GAGES, Height

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Homestrand, Inc., Larchmont, N. Y.
Neise, Karl A., Dept. M, 381 Fourth Ave., New York 16, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Plug, Ring and Snap

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Vinco Corp., 8855 Schaefer Highway, Detroit 27, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

GAGES, Surface

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Taper

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Vinco Corp., 8855 Schaefer Highway, Detroit 27, Mich.

GAGES, Thread

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Detroit Tap & Tool Co., Detroit, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vinco Corp., 8855 Schaefer Highway, Detroit 27, Mich.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

GASKETS

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

GEAR BLANKS, Non-Metallic

Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

GEAR BURNISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7173 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Vinco Corp., 8855 Schaefer Highway, Detroit 27, Mich.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

(Continued on page 340)

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Waltham Machine Works, Newton St., Waltham, Mass.

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Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Kelvin Systems Corp., 135 Front St., New York 5, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.

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Barber-Colman Co., Rock and Montague, Rockford, Ill.
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Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.

GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

GEAR GRINDING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Vinco Corp., 8855 Schaefer Highway, Detroit 27, Mich.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR MOTORS

See Speed Reducers.

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR TESTING MACHINERY

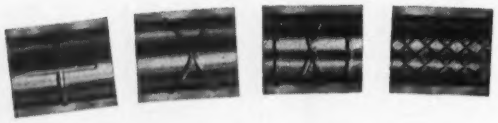
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, Cut

American Stock Gear Div., Perfection Gear Co., Harvey, Ill.
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, Ill.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Beldon Ave., Syracuse, N. Y.

(Continued on page 342)

High Speed
CONTINUOUS OIL GROOVING



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PIECES PER HOUR!

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Send us sample bearings to cut to specifications. We will return them, properly grooved, with a record of the time required and a cost-estimate. No obligation. Or, write for detailed, well-illustrated Bulletin.

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SINCE 1868

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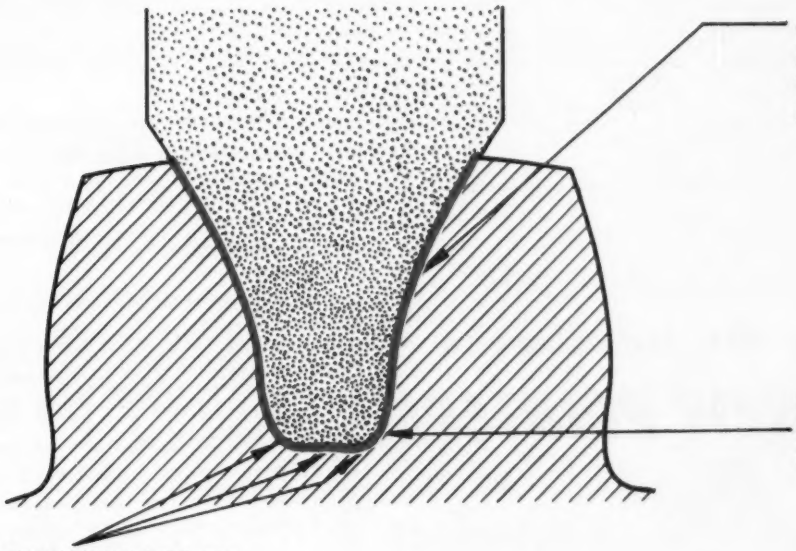
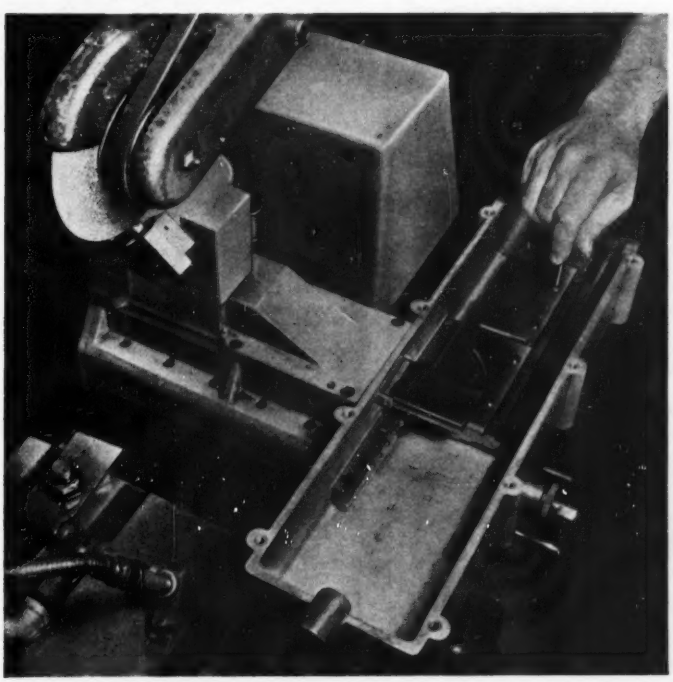

ONE CONTINUOUS AUTOMATIC DRESSING FOR INVOLUTE SIDES, ROOT, FILLETS & BOTTOM LAND
PRODUCES PERFECT BLEND BETWEEN INVOLUTE & ROOT FILLET
SMOOTH FLOW-IN OF ALL CURVES & TANGENTS, ELIMINATING STRESS CONCENTRATIONS

. . . . Use the Hoglund Automatic Hydraulic Dresser

The Hoglund Automatic Hydraulic Dresser, with cover removed to show template controlling diamond movement.



THE elimination of stress concentration at the root fillet is important in all gears and splines, but especially so in aircraft work. The Hoglund Automatic Hydraulic Dresser produces a smooth blending of all curves and tangents, plus . . .

1. Wheel dressed in one operation.
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4. Capacity up to 0.75″ wheel.

We make over 40 regular and special dressers, manual and automatic, for any contour job. Send us your blueprints, and have us submit our recommendations.

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Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Mass. Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Perkins Mch. & Gear Co., Box 1611, Springfield 2, Mass.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GEARS, Rawhide and Non-Metallic

American Stock Gear Div., Perfection Gear Co., Harvey, Ill.
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Beldon Ave., Syracuse, N. Y.
Earle Gear & Mch. Co., 4707 Stenton Ave., Wayne Junction, Philadelphia 44, Pa.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GENERATORS, Electric

General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Elec. & Engrg. Co., Collinwood Sta., 1088 Ivanhoe Rd., Cleveland, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

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American Optical Co., Southbridge, Mass.

GRADUATING MACHINES

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.

GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Pure Oil Co., 35 E. Wacker Drive, Chicago, Ill.
Shell Oil Co., 50 West 50th St., New York, N. Y.
Sinclair Refining Co., 630 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

GRINDERS, Carbide Tool

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N. Y.
Dumore Co., 1300 17th St., Racine, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co. 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

GRINDERS, Portable Electric and Toolpost

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Dumore Co., 1300 17th St., Racine, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Millers Falls Co., Greenfield, Mass.
Skil Corp., 5039 Elston Ave., Chicago, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

(Continued on page 344)

Teaching the Handbooks

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on

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(A) Profile Grinding from the solid
(C) Grinding Off-Balance objects
(B) Form Grinding multi-diameters
(D) Grinding Cylindrical objects

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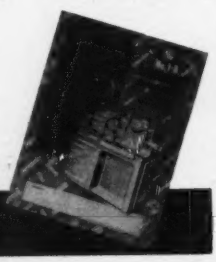

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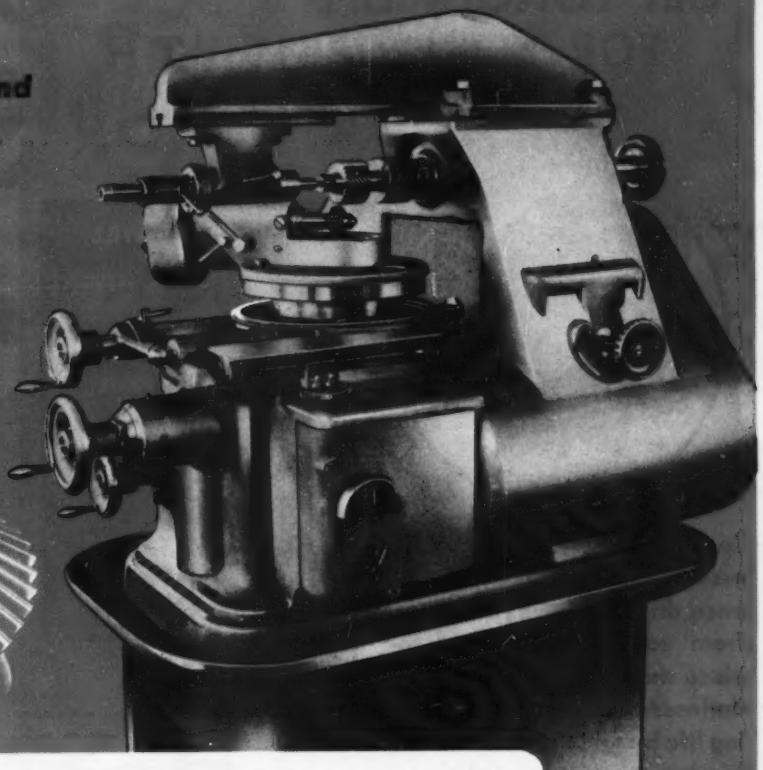

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Simple to operate!

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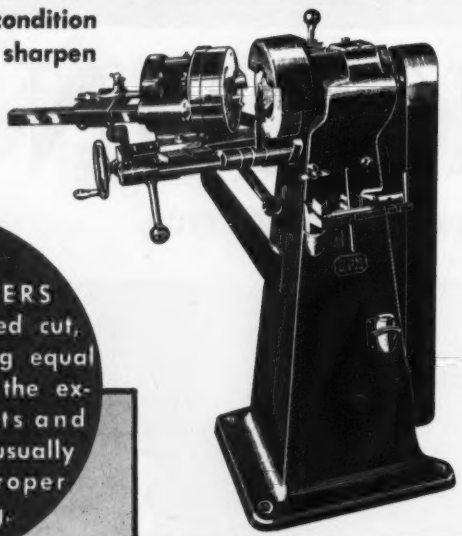

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Madison Mfg. Co., Muskegon Heights, Mich.

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Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Porter-Cable Mch. Co., Salina St., Syracuse, New York.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench

Atlas Press Co., 1253 N. Pitcher Ave., Kalamazoo, Mich.
Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

GRINDING MACHINES, Broach

Colonial Broach Co., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

GRINDING MACHINES, Camshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Carbide Tool

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GRINDING MACHINES, Centerless

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Diversified Metal Products Co., 5125 Alcoa Ave., Los Angeles 58, Calif.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Inc., Waynesboro, Pa.

GRINDING MACHINES, Chucking

Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Landis Tool Co., Inc., Waynesboro, Pa.

GRINDING MACHINES, Crankshaft

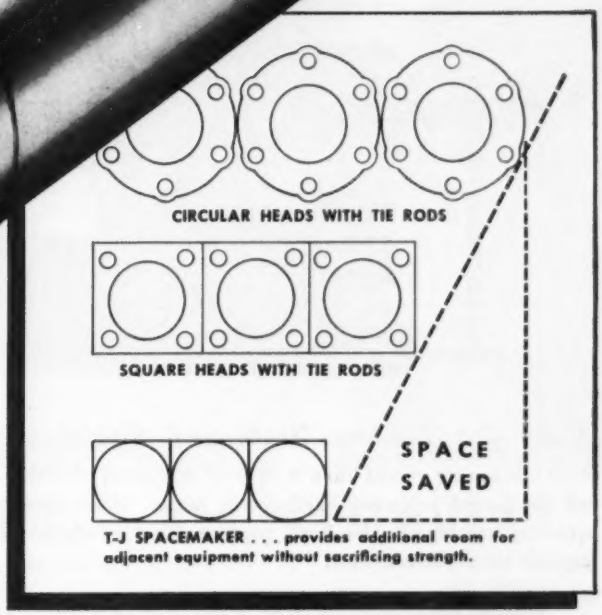
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.

(Continued on page 346)

NEW T-J Spacemaker AIR CYLINDERS



T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

- SAVES UP TO 40% SPACE WITH NEW STREAMLINED DESIGN.
- SUPER STRENGTH . . . EXTRA HIGH SAFETY FACTOR
- SOLID STEEL HEADS
- HEAVY WALL, PRECISION HONED, HARD CHROME PLATED, SEAMLESS STEEL BODY
- LEAKPROOF CYLINDER HEAD TO BODY CONSTRUCTION.
- RELATIVE PORT POSITIONS MAY BE ROTATED WITHOUT DISASSEMBLY OF CYLINDER AND LOCKED IN DESIRED POSITION.
- HEAVY DUTY, HI-TENSILE, HARD CHROME PLATED PISTON ROD.

Streamlined construction of the new T-J Cylinders *eliminates tie rods . . . reduces head size . . .* and *saves up to 40% in mounting space!* In addition, a new high in strength is achieved with solid steel heads and heavy wall seamless steel body . . . leakproof construction . . . extra high safety factor.

Cylinder walls are precision honed and hard chrome plated for long-life efficiency. Available with the new T-J Super Cushion Flexible Seals which insure positive cushion with automatic valve action for fast return stroke. Many standard sizes and styles . . . both cushioned and non-cushioned . . . for wide range of pushing, pulling, lifting, clamping or control jobs. T-J dependability. *Fast delivery* to meet rush requirements. Write for bulletin 8152. The Tomkins-Johnson Co., Jackson, Mich.

37 YEARS EXPERIENCE

Many More Advanced Features!

T-J **TOMKINS-JOHNSON**

RIVETORS · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHORS

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Dumore Co., 1300 17th St., Racine, Wis.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Kelvin Systems Corp., 135 Front St., New York 5, N. Y.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder, Inc. Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Die Chaser

Eastern Mch. Screw Corp., New Haven, Conn.
Landis Machine Co., Waynesboro, Pa.

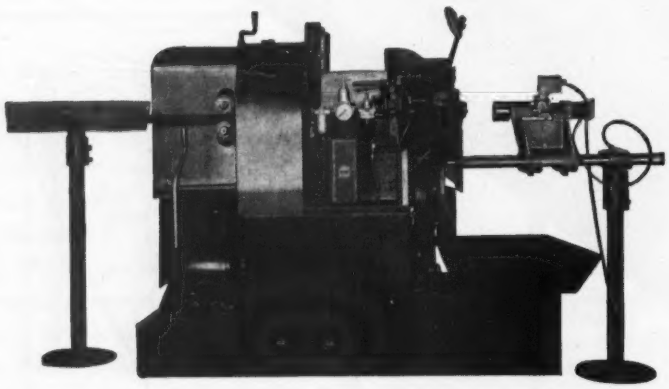
GRINDING MACHINES, Disc

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Mattison Machine Works, Rockford, Ill.
Porter-Cable Machine Co., Salina St., Syracuse, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Drill

Blake, Edward, Co., 442 Cherry St., West Newton 65, Mass.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

The NEW MODERN AUTOMATIC
CUTTING-OFF MACHINE



Cuts Off Tubing, Pipe and Shafting . . . FAST

Cuts off longer pieces than a regular automatic machine. In fact, cuts off *any length you want*—and cuts it *faster*. If your production *requires* quantity cutting-off of tubing, pipe or shafting, check the figures below against your present time.

1/2" Tubing

This machine cuts off and chamfers both outside edges of ½" .030 wall tubing, 5" long, at the rate of one every 2.5 seconds.

1 1/4" Cold Rolled

This machine cuts off and chamfers both ends of 1¼" cold rolled, 20" long, at the rate of one every 20 seconds.

1" Tubing

This machine cuts off and chamfers both outside edges of 3" long, at the rate of one every 3 seconds.

These popular, time saving machines are now available in four sizes, handling work up to 6¾" O.D. Their many cost cutting features are described and illustrated in our latest catalog that will be mailed promptly on request.

4" Threaded Studs

Cut and chamfered at one time—in 8 seconds—from 10 ft. length of stock already threaded. (¾" U. S. Standard.) Clean cut. Clean chamfer. Nuts start easily, with no extra finishing required.

WRITE FOR ILLUSTRATED CATALOG.

MODERN MACHINE TOOL CO.
Jackson, Michigan

Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, Face

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment.

GRINDING MACHINES, Gap

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth

See Gear Grinding Machines.

GRINDING MACHINES, For Sharpening Cutters, Reamers, Hobs, Etc.

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Blake, Edward, Co., 442 Cherry St., West Newton 65, Mass.
British Industries Corp., 164 Duane St., New York, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, For Sharpening Turning and Planing Tools

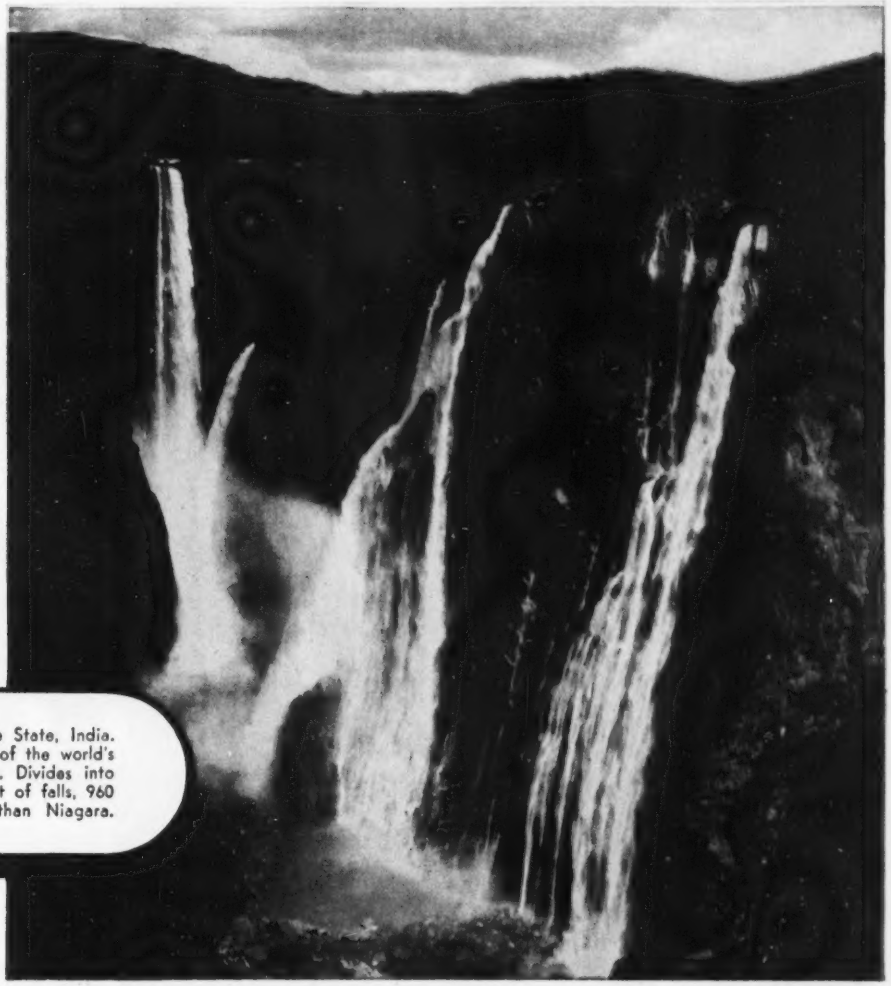
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

GRINDING MACHINES, Internal

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Dumore Co., 1300 17th St., Racine, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Neise, Karl A., Dept. M, 381 Fourth Ave., New York 16, N. Y.

(Continued on page 350)

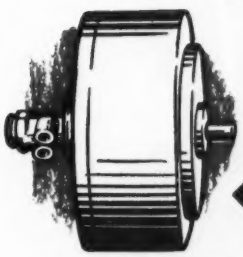
LOGAN FLUID POWER • DURABLE, DEPENDABLE SINCE 1916



Gersoppa Falls in Mysore State, India. India's greatest and one of the world's most spectacular wonders. Divides into four separate falls. Height of falls, 960 feet, five times higher than Niagara.

LOGAN *ROTATING AND NONROTATING* AIR CYLINDERS

FAST-ACTING, POSITIVE CONTROLLED POWER . . . AT LOW COST



Rotating Air Cylinder

NONROTATING—7 STANDARD MOUNTING TYPES

Standard sizes from 1½" to 16" bore; maximum stroke, 18 feet. Special models to meet your requirements.

Logan Features—Larger Ports . . . More Sturdy Construction . . . Maximum Power Without Leakage . . . Permanent Seal Around Piston Rod . . . Standard Models With or Without Cushioning.

ROTATING

Two Standard Styles—Type R with cast iron body; Type K with lightweight aluminum body.

Bore diameter 1½" to 20"; piston stroke 1" to 2"; longer strokes available as special. American Standard adaptations.

Nonrotating Double-Acting Air Cylinder

Consult Logan for your special heavy-duty, mill-type cylinder requirements

LOGAN MANUFACTURES 6,975 STANDARD CATALOGED ITEMS

FREE CATALOG ON REQUEST

AIR CONTROL VALVES, Cat. 100-6 • AIR CHUCKS, Cat. 70-1 • AIR CYLINDERS, Cat. 100-1 • AIR-DRAULIC CYLINDERS, Cat. 100-3
AIR and HYDRAULIC PRESSES, Cat. 51 • COLLET GRIP TUBE FITTINGS, Cat. 200-5 • HYDRAULIC CONTROL VALVES, Cat. 200-4
HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 • HYDRAULIC POWER UNITS, Cat. 200-1 • SURE-FLOW COOLANT PUMPS, Cat. 62

SAVES TIME — Logan — AIR AND HYDRAULIC EQUIPMENT — REPORT • MOTION

LOGANSPORT MACHINE CO., INC., 810 CENTER AVE., LOGANSPORT, IND.

WHAT *Life-Line* REALLY DELIVERS IS MORE SERVICE...LESS SERVICING

Only modern motors and controls give you these features

Motors and controls have been built much the same way for years. Motors required frequent lubrication . . . controls needed constant maintenance. But, you can get really modern equipment built to standards that match today's speeded production requirements.

"De-ion®" arc quenching used on Life-Linestarters has proved the most efficient method of increasing contact life and interrupting capacity. Pictured on the left is the exclusive Westinghouse "De-ion" Quencher at work. In 1/120 of a second, arcs are confined, divided, extinguished—a *basic* to long contact life and equipment protection. It's the last word in arc quenching. Combined with silver contacts, this "De-ion" principle eliminates the need for constant contact maintenance. Contacts *never need* filing.

Pre-lubricated bearings on Life-Line motors have introduced new freedom from motor maintenance. You eliminate bearing failures due to overlubrication, under lubrication, and from entrance of dirt into bearings. Result is reduction of motor down time. Certainly, the way to grease a modern motor is *don't.* Results of over half a million Life-Line motors serving every phase of industry show motor failures cut in half!

It's this kind of advanced features that puts Life-Line motors and Life-Linestarters years ahead of conventional equipment. Get all the reasons why. Ask your Westinghouse representative for full details, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21693-A

YOU CAN BE SURE...IF IT'S Westinghouse

Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

GRINDING MACHINES, Jig

Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING MACHINES, Knife and Shear Blade

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Hanchett Mfg. Co., Big Rapids, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.

GRINDING MACHINES, Piston Ring

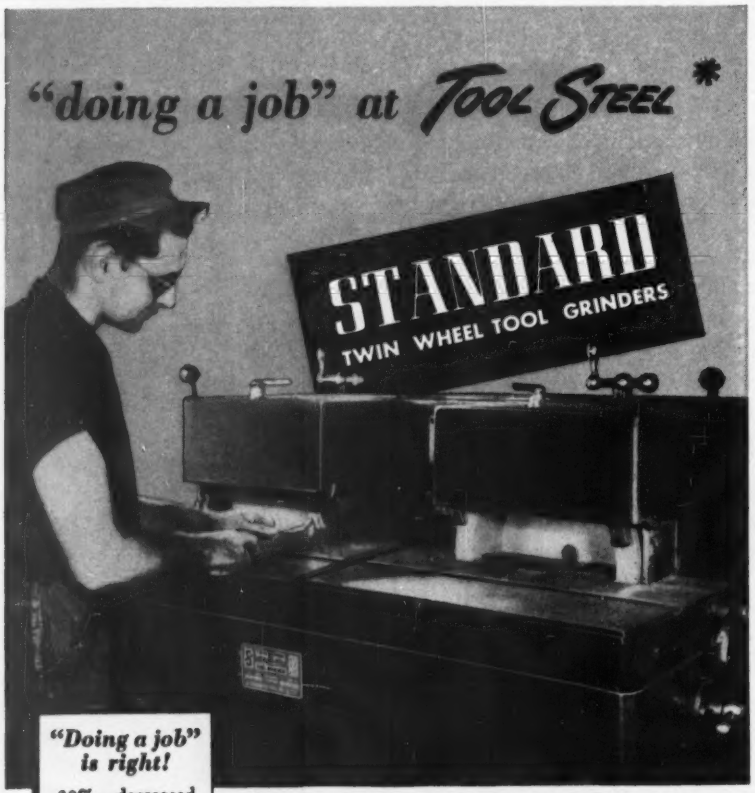
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Profile

Cleveland Grinding Machine Co., 1643 Eddy Rd., Cleveland 12, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Radial, Ball Race, Etc.

Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Landis Tool Co., Waynesboro, Pa.



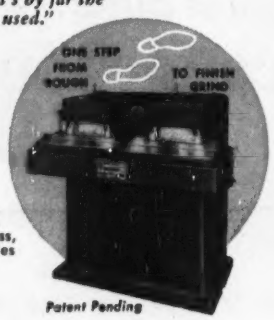
"Doing a job" is right!

30% decreased grinding time, grinding costs way down, less operator fatigue, greater wheel life, increased production.

* Here's what the Tool Room Superintendent at the Tool Steel Gear and Pinion Co., Cincinnati, Ohio says:

"Since installation this Standard Tool Grinder has had no downtime . . . required no maintenance other than routine. We use the machine daily, sometimes continuously on production wet-grinding of carbide tipped hub-turning, offset turning, boring and other high-speed steel tools. It's by far the best precision grinder we've used."

Outstanding performance? No . . . just typical of the Standard Twin Wheel Tool Grinder. Available in 10" and 14" wheel sizes; wet or dry. No spray or splash when wet-grinding. Two operators can grind at once. Conserves floor space. Write for Bulletin TW today for full details.



Patent Pending

standardize with . . . the **STANDARD** electrical tool co.
2500 RIVER RD. • CINCINNATI 4 • OHIO

See us at Booth 660, Western Metal Congress, March 23-27, Los Angeles

GRINDING MACHINES, Radius, Link

Consolidated Mch. Tool Corp., Rochester, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

GRINDING MACHINES, Ring Wheel

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll

Farrel-Birmingham Co., 25 Main St., Ansonia, Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft

Kelvin Systems Corp., 135 Front St., New York 5, N. Y.

GRINDING MACHINES, Surface

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
British Industries Corp., International Machinery Div., 164 Duane St., New York, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight Ave., S.W., Grand Rapids 4, Mich.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Tap

Blake, Edward, Co., 442 Cherry St., West Newton 65, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING MACHINES, Thread

Dumore Co., 1300 17th St., Racine, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Landis Tool Co. (Centerless), Waynesboro, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Kelvin Systems Corp., 135 Front St., New York 5, N. Y.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Worm

Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.

(Continued on page 354)

How the Fable of

"The Birds, The Beasts & The Bat"

has a parallel in Cutting Fluids

. . . thanks to Aesop for this Fable

The Birds were engaged in a fierce battle with the Beasts. The Bat figured he could pass as either a Bird or a Beast and he wanted to be on the winning side. As the battle see-sawed he flitted back and forth. The Birds finally won but the Bat got back to their side too late and was chased away to a cave, where he has lived ever since, ashamed to come out except at night.

The Parallel . . .

Like the Bat in the fable, some cutting fluids appear to be both Bird and Beast, but may be neither. If you are going to tap a tough, difficult to machine metal you need a heavy duty cutting oil with high *anti-weld* and good *lubricity* characteristics. On a less exacting light milling job a conventional water-mix fluid with good temperature regulating properties is usually the answer.

The point the fable emphasizes is that a cutting fluid can't be on both sides of the fence. You don't need a different fluid for every job but you need one that's *right* for the job. Stuart products and Stuart experience will give you the best possible results in terms of finish, tool life and production. Ask to have this demonstrated to you by a Stuart Representative.

More Than a "Coolant" is Needed

D.A. Stuart Oil Co.
EST. 1865 LIMITED

TIME-TESTED CUTTING FLUIDS AND LUBRICANTS

2739 S. Troy St., Chicago 23, Ill.

SEND FOR BOOKLET *entitled More Than a "Coolant" is Needed*

CLIP TO YOUR COMPANY LETTERHEAD AND MAIL

to D. A. Stuart Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.

Your Name .....

Title .....

ATKINS and BORG-WARNER

Team up for Greater Things in '53!

New products • Broader engineering

New design and metallurgical developments

Extra research facilities

Greater production capacities

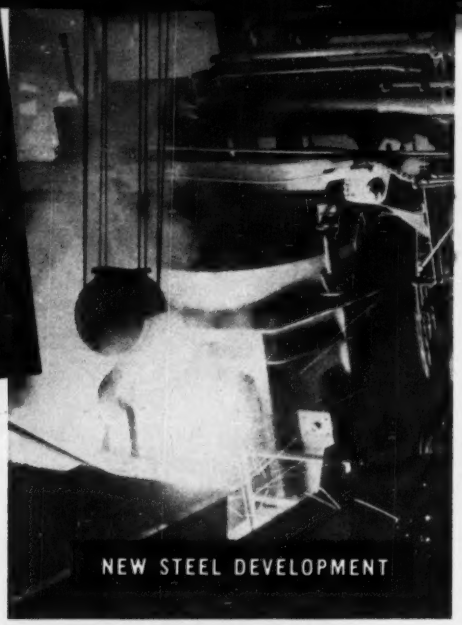
You can expect big things from Atkins this year—and in the years to come—the biggest developments in the saw industry!

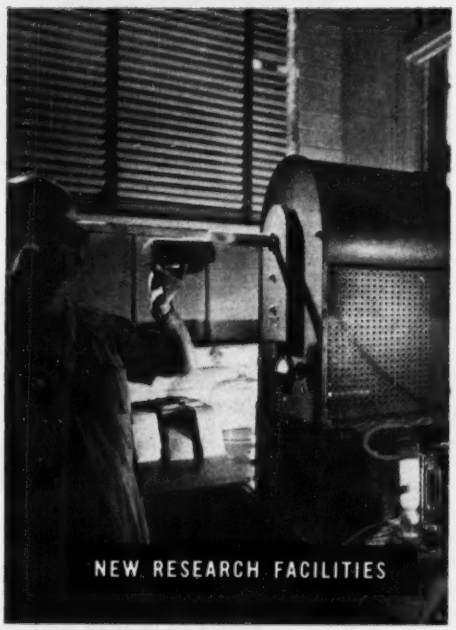
You've seen many "firsts" from Atkins. Now you'll see even more—in blade and tooth designs, in metallurgy, in creative engineering. You'll find this team ready to work on your own specific cutting problems. You'll get new engineering services, in the field, from Atkins representatives. And you'll see evidence of all this new activity in long and satisfactory saw life and fast, smooth production on every cutting operation.

And throughout all these developments, you'll still get dependable *Silver Steel* and all it stands for—the know-how and experience which have made Atkins the pioneer and the leader in industrial and mill saw engineering.

Borg-Warner now complements Atkins craftsmanship, adding new research and development facilities to this historic 96-year-old Atkins name.

Keep your eye on Atkins for the biggest news in saws!





ENGINEERING B-W PRODUCTION

ATKINS Silver Steel SAWS

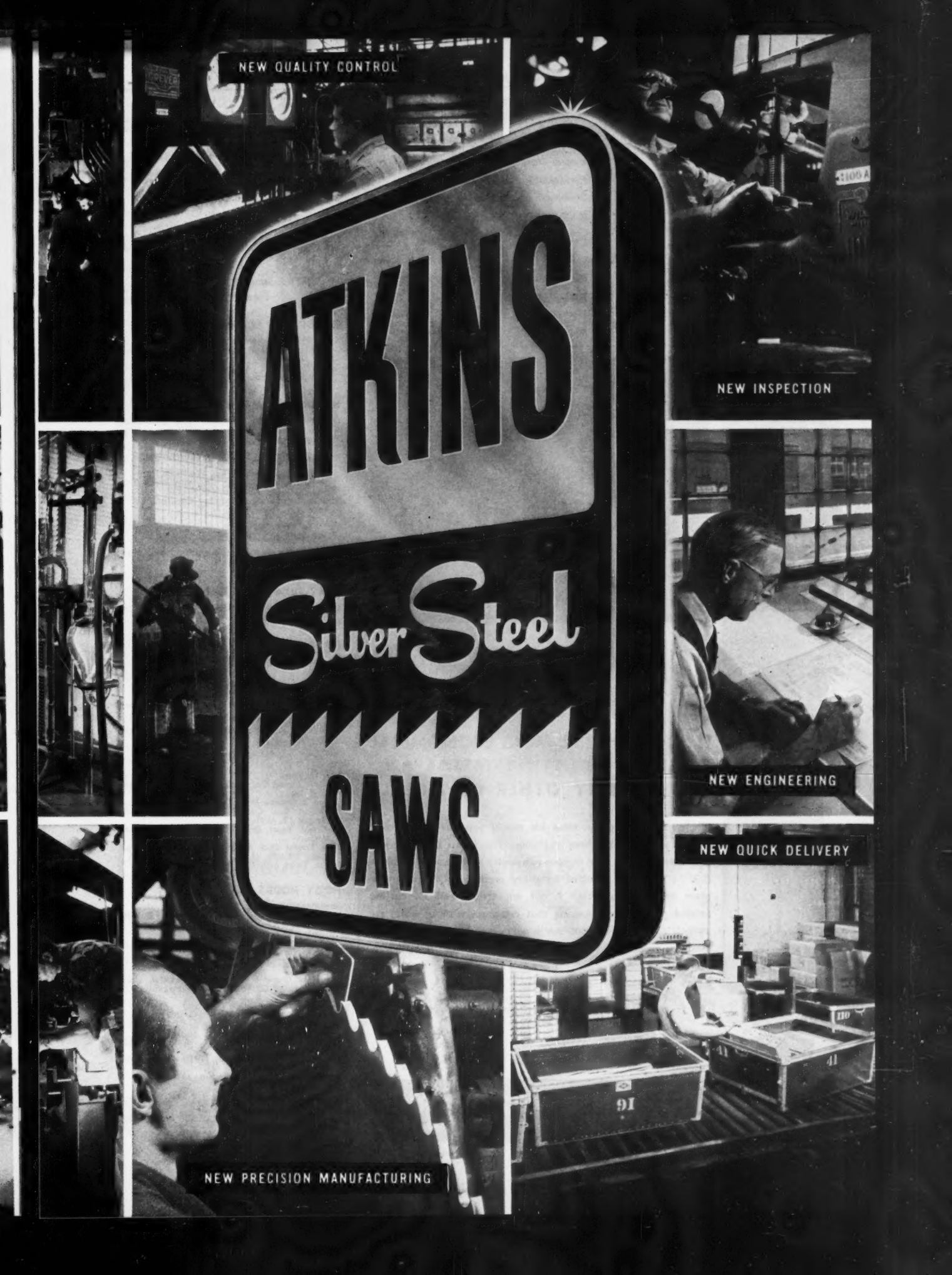
Now..

ATKINS SAW DIVISION

BORG-WARNER CORPORATION

(SUCCESSOR TO E. C. ATKINS AND COMPANY)

INDIANAPOLIS 9, INDIANA


NEW QUALITY CONTROL
NEW INSPECTION
ATKINS
Silver Steel
SAWS
NEW ENGINEERING
NEW QUICK DELIVERY
NEW PRECISION MANUFACTURING

GRINDING WHEELS

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Bay State Abrasive Products Co., Westboro, Mass.
Besly-Welles Corp., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Cincinnati Milling Machine Co., Grinding Wheels Div., Cincinnati, Ohio.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Precision Diamond Tool Co., 102 South Grove Ave., Elgin, Ill. (Diamond).
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

GROOVING TOOLS, Internal

Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

HAMMERS, Drop

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbia Machinery & Engineering Corp., Hamilton 1, Ohio.
Morgan Engrg. Co., Alliance, Ohio.

HAMMERS, Forging Air

Chambersburg Engrg. Co., Chambersburg, Pa.

HAMMERS, Pneumatic

Chambersburg Engrg. Co., Chambersburg, Pa.
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Cleco Div., Reed Roller Bit Co. 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.

HAMMERS, Portable Electric

Black & Decker Mfg. Co., E. Penna Ave., Towson, Md.
Millers Falls Co., Greenfield, Mass.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.

HAMMERS, Shaft

S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

HAMMERS, Soft

Chambersburg Engrg. Co., Chambersburg, Pa.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

HAMMERS, Steam

Chambersburg Engrg. Co., Chambersburg, Pa.

HARDENING EQUIPMENT

Lepel High Frequency Laboratories, Inc. (Induction), 55th St. and 37th Ave., Woodside 77, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

HARDENING MACHINES, Flame

Cincinnati Milling Machine Co., Cincinnati, Ohio.

HARDNESS TESTING INSTRUMENTS

Ames Precision Mch. Wks., Waltham, Mass.
Shore Instrument & Mfg. Co., Van Wyck Ave. and Carll St., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HEADING MACHINES

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

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(Continued on page 356)

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(Continued on page 358)

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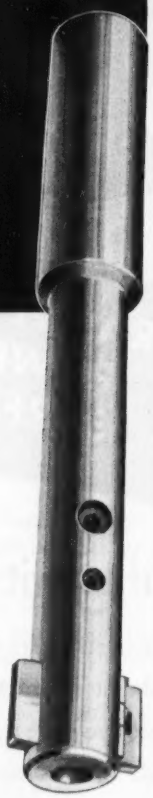

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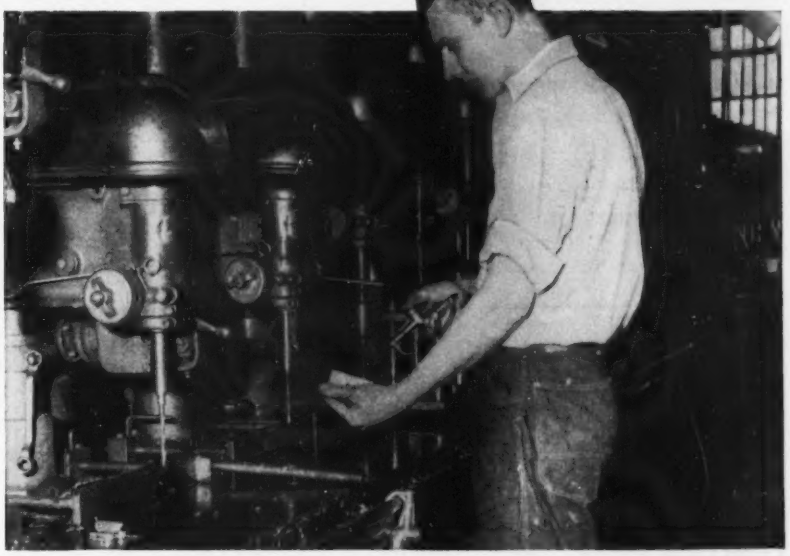

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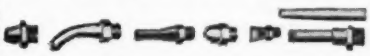

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(Continued on page 360)

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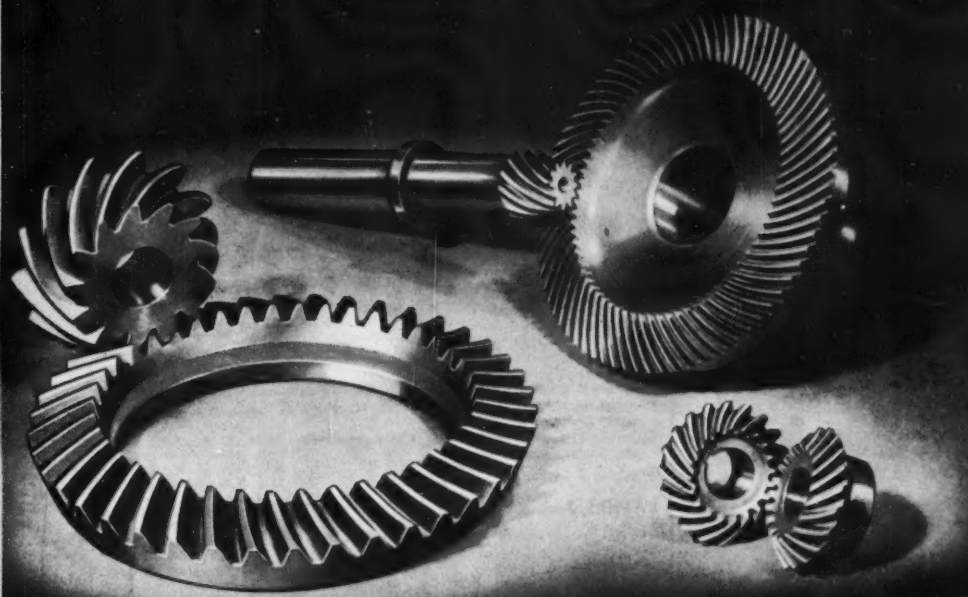

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Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

LATHES, Manufacturing Type

Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

LATHES, Spinning

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom

See Lathes, Engine and Toolroom.

LATHES, Turret

Bardons & Oliver, Inc., Ft. W. 9th St, Cleveland 13, Ohio.

(Continued on page 362)

Cleco B-1 Scaler removing weld scale from part of a power shovel frame.

Cleco 1460-A Grinder on industrial truck frame assembly line.

Cleco 103-AR Drill reaming holes in industrial truck frame.

COST RECORDS SHOW CLECO AIR TOOLS REQUIRE LESS MAINTENANCE

A progressive Ohio welding company has developed a carefully planned air tool maintenance and repair program that helps keep costs down.

One feature of this program is that it gives management accurate maintenance cost figures on air tools.

These cost figures have shown—to the company's satisfaction—that maintenance of Cleco Air Tools is at a minimum.

We would appreciate the opportunity of proving to *you* the low maintenance on Cleco Air Tools. Call, write or wire the nearest Cleco office listed below.

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PENNSYLVANIA: Philadelphia 20, 5220 N. Fifth St. . . . Pittsburgh, Room 621, Highland Bldg.

In Canada: Cleco Pneumatic Tool Company of Canada, Ltd., 927 Millwood Road, Toronto (Leaside), Ontario
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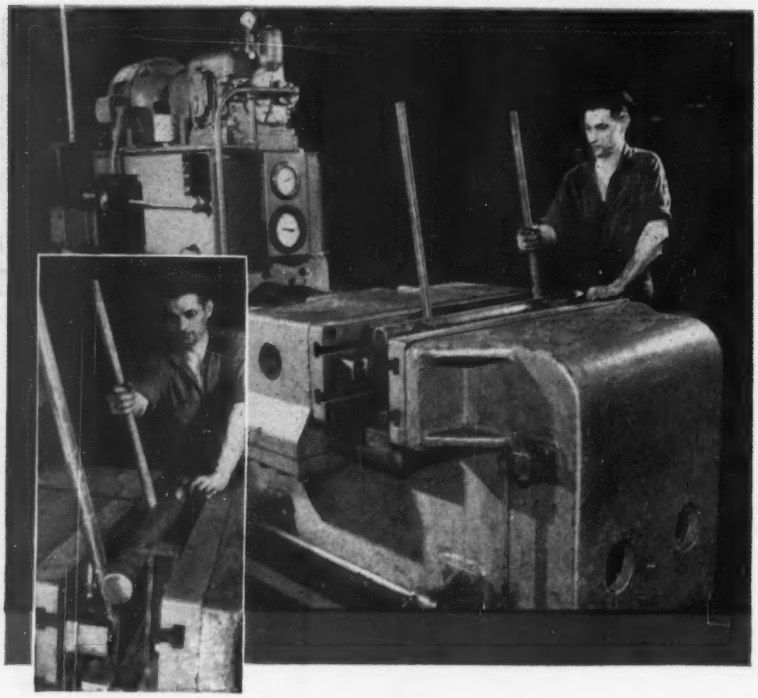

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FARQUHAR Hydraulic Press

Mercury Manufacturing Co., Chicago, Ill., producers of fork trucks, tractors and trailers, uses a 200-Ton Farquhar Horizontal Bulldozer press to make forgings and stampings and to form plates. In operation 8 hours a day, the press does most jobs twice as fast as the mechanical bulldozer used formerly, and better speed control produces better work.

In addition, many pieces of work that used to be farmed out are now done at Mercury—providing better production and quality control, and effecting additional savings of time.

In the operation shown above, high carbon brazed steel is bent quickly and accurately. In other operations, the press forms heads on bolts, legs for caster forms, and bends structural T frames.

Mercury reports very small maintenance costs, and sums up the company's satisfaction with, "It's the best!"

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Just one more example of cost-cutting Farquhar performance in heavy production! Farquhar Presses are built for the job . . . assure faster production due to rapid advance and return of the ram . . . greater accuracy because of the extra guides on moving platen . . . easy, smooth operation with finger-tip controls . . . longer life due to positive control of speed and pressure on the die . . . long, dependable service with minimum maintenance cost!

Farquhar engineers are ready to help solve whatever production problem you may have. Give them a call.

Send for Free Catalog showing Farquhar Hydraulic Presses in all sizes and capacities for all types of industry. Write to: A. B. FARQUHAR CO., *Hydraulic Press Dept.*, 1504 Duke St., York, Pa.

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Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc. (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morey Mchry. Co., Inc., 410 Broome St., New York, N. Y.
Murad Developments Ltd., Aylesbury, Bucks, England.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Potter & Johnston Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Vertical Turret

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Lehmann, J. M., Co., Inc., 55 New York Ave., Lyndhurst, N. J.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

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Bullard Co., Brewster St., Bridgeport 2, Conn.
Millers Falls Co., Greenfield, Mass.
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Starrett, The L. S., Co., Athol, Mass.

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Link-Belt Co. (For Positioning Bearings), 519 N. Holmes Ave., Indianapolis 6, Ind.
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Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Pure Oil Co., 35 E. Wacker Drive, Chicago, Ill.
Shell Oil Co., 50 West 50th St., New York, N. Y.
Sinclair Refining Co., 630 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
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Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

MACHINISTS' SMALL TOOLS

See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

MANDRELS

See Arbors and Mandrels.

(Continued on page 364)

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on SURFACE GRINDERS

specify **POPE P32-T** Direct Motorized Cartridge Type with strong, oversize 1 HP, 3450 RPM totally enclosed motor.

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specify the NEW series of **POPE** belt driven, cartridge type Precision Internal Grinder Spindles, up to 54,000 RPM, with chrome plated, stationary cap in place of the old, revolving type.

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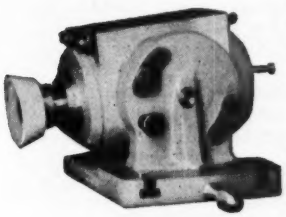

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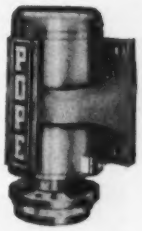
specify **POPE P-2500** Heavy Duty Direct Motorized Spindle for grinding, milling, boring —¾ to 100 HP.



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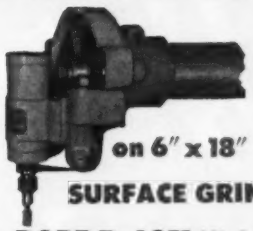

on 6" x 18" SURFACE GRINDERS

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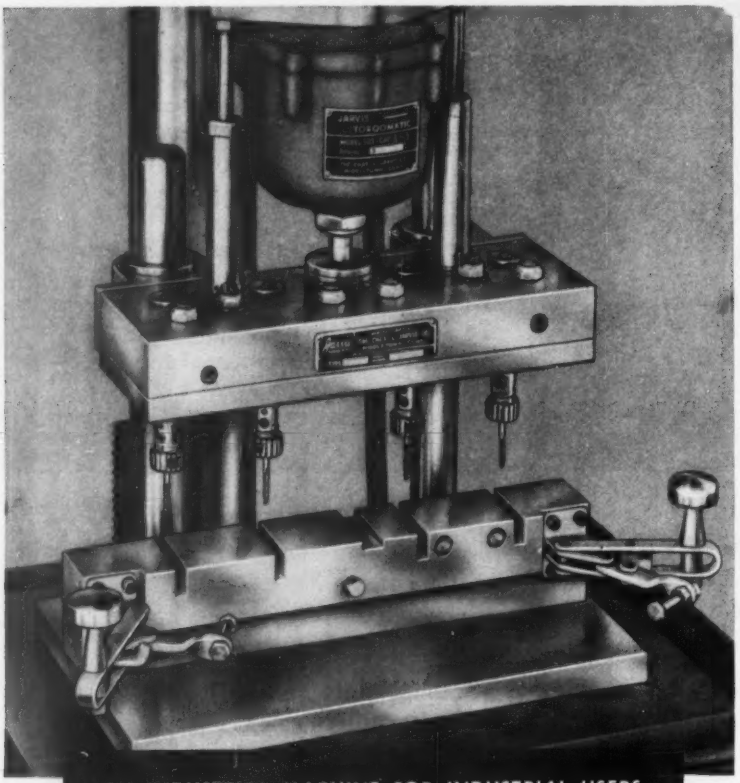

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Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
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See Recording Instruments.

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Millers Falls Co., Greenfield, Mass.
Neise, Karl, A., Dept. M, 381 Fourth Ave., New York 16, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
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Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Porter-Cable Machine Co., Salina St., Syracuse, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING AND CENTERING MACHINES
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Automatic
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.

Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench

Atlas Press Co., 1253 N. Pitcher St., Kalamazoo, Mich.
Hardinge Bros., Inc. (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Circular Continuous

Consolidated Machine Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain and Universal

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
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Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Marac Mchry. Corp., 1819 Broadway, New York, N. Y.
Neise, Karl A., Dept. M, 381 Fourth Ave., New York 16, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
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(Continued on page 366)

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MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Planer Type

Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Planetary Type

Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.

MILLING MACHINES, Profile

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

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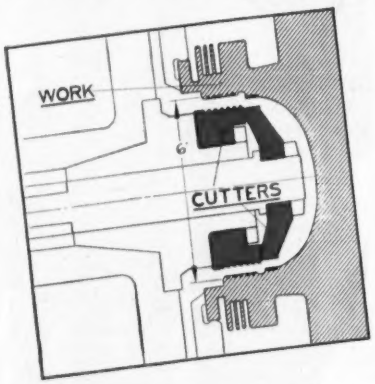
another job for the HALL PLANETARY!



Simultaneous milling of threads and shrink bands in cylinder heads!

Where accurate relationship between several surfaces is desired, you can make sure of concentricity by putting the job on a Hall Planetary Milling Machine. In the job shown, the thread and adjacent bore are Planathreaded and Planamilled simultaneously — to aircraft standards of accuracy.

In the Hall Planetary the planetary movement is obtained by rotating eccentric containers. The spindle on which the cutter is mounted rotates within these eccentrics and moves in a circular arc from the center, entering the work near the extreme of the eccentric. The cutter then moves around the circumference of the work in one revolution, automaticgally returning to center to complete the cycle. The razor edge at the start and stop of threads is automatically removed.

This job points out another Hall Planetary advantage: The work is held stationary, a feature which simplifies the handling of parts which, because of their shape or bulk, are not easily rotated. Furthermore, because the work fixture is secured to the head, accuracy and rigidity are assured.

MILLING MACHINES, Turret Type

Bridgeport Machine, Inc., Linley Ave., Bridgeport, Conn.

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British Industries Corp., International Mchry. Div., 164 Duane St., New York, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Marac Mchry. Co., 1819 Broadway, New York N. Y.
Neise, Karl A., Dept. M, 381 Fourth Ave., New York 16, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MODEL AND EXPERIMENTAL WORK

See Special Machinery and Tools.

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Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.

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American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

MOTORS, Electric

Delco Products Div., General Motors Corp., 321 E. First St., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
Reliance Electric & Engrg. Co., Collinwood Sta., 1088 Ivanhoe Rd., Cleveland, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

MOTORS, Hydraulic

Gerotor May Corp., Oliver St. and Maryland Ave., Baltimore, Md.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MULTIPLE-SLIDE FORMING MACHINES

Nilson Machine Co., A. H., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

NIBBLING MACHINES

Campbell Machine Div., American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport, Conn.
Wales-Strippit Corp., North Tonawanda, N. Y.

NIBBLING MACHINES, Nickel

International Nickel Co., Inc., 67 Wall St., New York, N. Y.

NIPPLE THREADING MACHINERY

Landis Machine Co., Inc., Waynesboro, Pa.

NUT MAKING MACHINERY

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

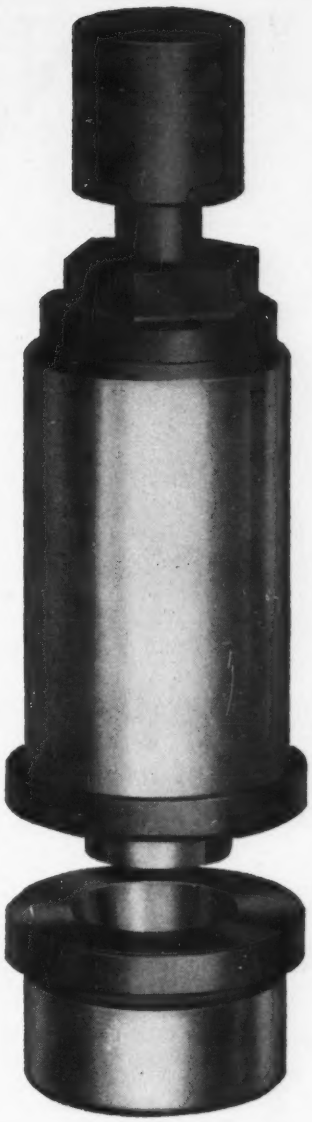
(Continued on page 368)

STANDARDIZED

UNIVERSAL INDEX PLUNGERS

SAVE TIME
SAVE MONEY

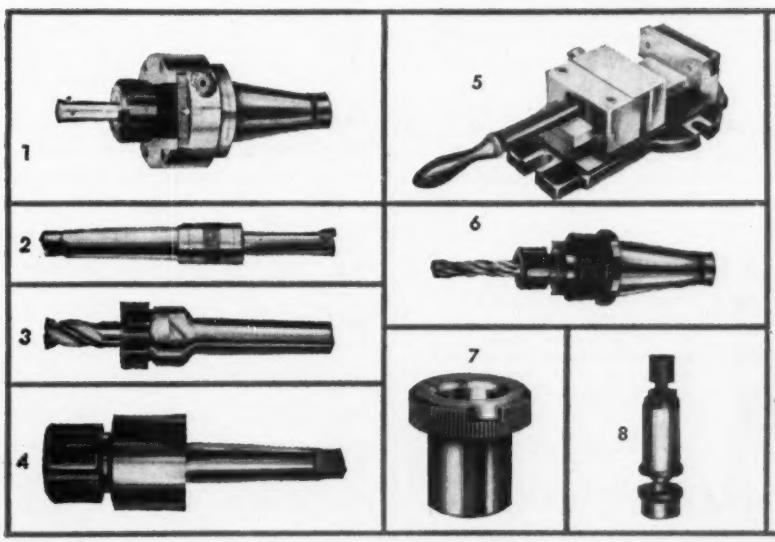
Universal's Straight and Taper Plungers made in standard sizes save the time and expense of designing and machining special index plungers for multi-station tools. They come to you complete, ready for installation at approximately ¼ the cost of specially made plungers.



Soft pin knob permits connection to actuating lever or air cylinders by several different methods. Locating bushing, plunger and plunger bushing are hardened and ground.

Plunger is easily assembled from either top or bottom. And it can be removed in either direction by removal of hex nut.

Universal Plungers greatly simplify jig or fixture manufacture because plunger body and bushing have same diameter so that all holes can be bored with same tool, often in same setting.



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(6) "KWIK-SWITCH" TOOL HOLDER
(7) STANDARD DRILL BUSHING
(8) UNIVERSAL INDEX PLUNGER

168

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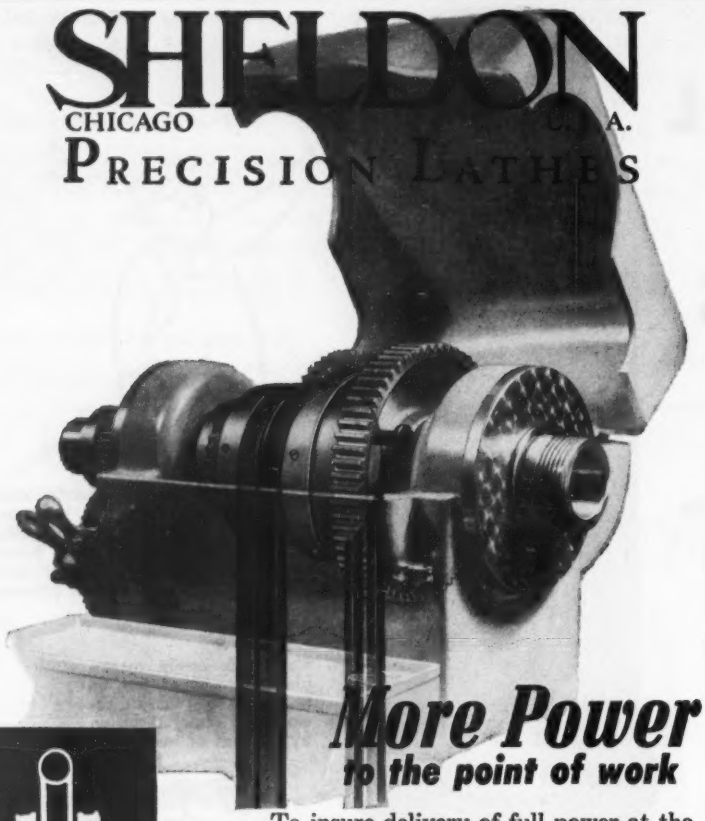
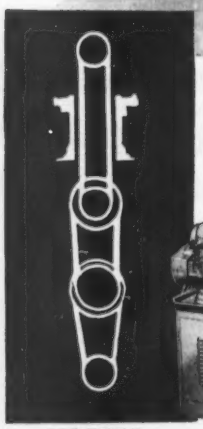
CHICAGO U. S. A.
PRECISION LATHES



More Power
to the point of work

To insure delivery of full power at the point of work . . . to prevent slippage on heavy cuts, the underneath motor drives of SHELDON Precision Lathes have double V-Belts driving the spindle. Tandem V-Belts, each of which engages the spindle around a full 50% of its circumference.

You will note a feature of SHELDON underneath motor drives not common to other moderate priced lathes is the extra, underneath counter shaft that permits driving thru a *standard* 1-piece lathe bed. There is no cutting away of the bed for belt clearance, nor use of "spliced" beds, in SHELDON Precision Lathes.



"E" TYPE

Completely enclosed in the cabinet leg, the SHELDON Type "E" Underneath Motor Drive has matching 4-step, V-Belt sheaves which provide 4 speeds (8 spindle speeds). All belts are provided with individual means for permanent adjustment of tension.

"U" TYPE

With a SHELDON Type "U" Underneath Motor Drive, all speed changes are instant—are made by clutches operated by levers that are conveniently located outside the enclosed cabinet leg. 4-speeds (8 spindle speeds) and individual belt tensioning means are provided.

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4246 North Knox Ave., Chicago 41, Illinois

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See Screw Driving and Nut Setting Equipment.

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See Bolt and Nut Machinery.

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Union Drawn Steel Co. Div., Republic Steel Corp., Massillon, Ohio.

NUTS, Self-Locking

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NUTS, Thumb or Wing and Cap

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Republic Steel Corp., Bolt and Nut Div., Republic Bldg., Cleveland 1, Ohio.
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(Continued on page 370)

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Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
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S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

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Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

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(Continued on page 372)

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Ferracute Machine Co., Bridgeton, N. J.
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(Continued on page 374)

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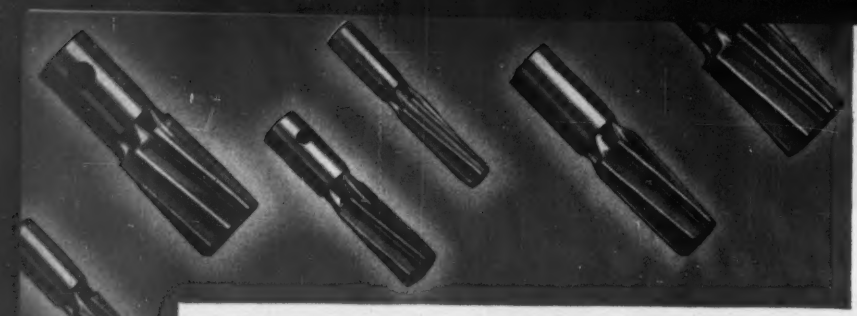

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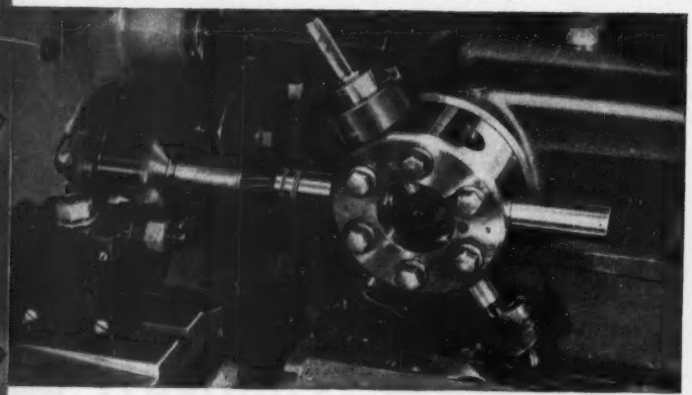

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Chambersburg Engrg. Co., Chambersburg, Pa.
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Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Farquhar Co., A. B., 21 Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Calif.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Mch. & Tool Works (Hydraulic), 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.

PROFILING MACHINES

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Morey Mchry. Co., Inc., (and Affiliated companies), 410 Broome St., New York, N. Y.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

PULLEYS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

PULLEYS, Friction Clutch

Brown & Sharpe Mfg. Co., Providence, R. I.

PUMPS, Coolant, Lubricant and Oil

Bowser, Inc., 1365 E. Creighton Ave., Fort Wayne, Ind.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 620 E. Vienna Ave., Milwaukee, Wis.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., Logansport, Ind.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Gerotor May Corp., Oliver St. and Maryland Ave., Baltimore, Md.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll-Rand Co., Phillipsburg, N. J.

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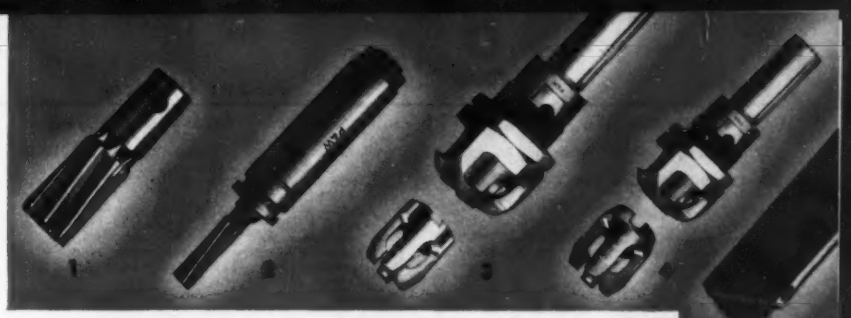

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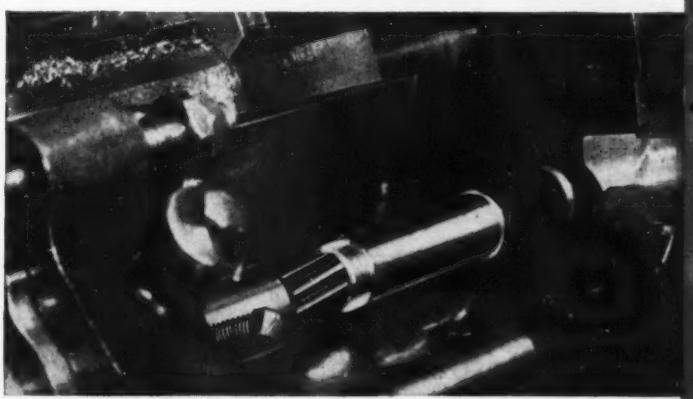
Screw Machine

CUTTING TOOLS

ASSURE UNIFORM QUALITY and DEPENDABLE ACCURACY



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Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill.
Viking Pump Co., Cedar Falls, Iowa.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PUMPS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.

PUMPS, Rotary

Bowser, Inc., 1365 E. Creighton Ave., Fort Wayne, Ind.
Brown & Sharpe Mfg. Co., Providence, R. I.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Vacuum

Leiman, Inc., 156 Christie St., Newark, N. J.

PUNCHES AND DIES

See Dies, Sheet Metal, Etc.

PUNCHES, Centering

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

PUNCHING MACHINERY

Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Columbia Machinery & Engineering Corp., Hamilton 1, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Kling Bros., Engineering Works, 1320 No. Kostner Ave., Chicago 51, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Wales-Strippit Corp., North Tonawanda, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

PYROMETERS

Bristol Co., Platts Mills, Waterbury, Conn.

RACKS, Gear Cut

Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Massachusetts Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

REAMER HOLDERS

Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Warner & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

REAMERS

Atrax Co., Newington, Conn.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

REAMERS, Adjustable

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Madison Mfg. Co., Muskegon Heights, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

REAMERS, Taper Pin

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kaufman Manufacturing Co., Manitowoc, Wis.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.

REAMING MACHINES

Greaves Machine Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

RECORDING INSTRUMENTS for Counting

National Acme Co., 170 E. 131st St., Cleveland, Ohio.

RECORDING INSTRUMENTS for Electricity

Bristol Co., Platts Mills, Waterbury, Conn.
General Electric Co., Schenectady, N. Y.

RECORDING INSTRUMENTS for Pressure

Bristol Co., Platts Mills, Waterbury, Conn.

(Continued on page 378)

Coniflex* type bevel gear, used in lift truck

Three Cheers for Gears by CINCINNATI

Ever know a customer of The Cincinnati Gear Company who was anything but satisfied? That's because we stand behind our products. If there was ever an order not right—we made it right. And that's why customers everywhere have confidence in us.

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Worm
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*Coniflex Bevel
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"MARVEL" HAS always had the edge

MARVEL High-Speed-Edge Blades assure Faster, more Accurate cutting with proven Economy and complete Safety. Only the MARVEL is a composite blade with a high-speed-steel cutting edge electrically welded to an exceptionally tough, strong alloy steel body.

The High-Speed-Edge does the cutting while the alloy back, with hardened eyes, carries the load. Blade tensions up to 300% higher than those possible with ordinary blades are recommended. This greater tension is confined to the cutting or leading edge by the location of pin holes (exclusive MARVEL design feature) and cannot be overcome by work resistance. Heavier feeds and greater speeds are practical without "run out."

With greater accuracy, higher production and lower cost per cut, comes the extra dividend of Safety, for MARVEL High-Speed-Edge Hack Saw Blades are Positively Unbreakable—*they will not shatter.*

Ask your local MARVEL distributor (see classified phone book) to help you modernize your metal sawing with MARVEL High-Speed-Edge Blades. They cost no more than ordinary high-speed-steel blades.

1. High-Speed-Steel cutting edge.

2. Tough unbreakable alloy steel body with hardened eyes.

1 & 2. Integrally welded to make a fast-cutting, long lasting composite blade that is **positively unbreakable.**

ARMSTRONG-BLUM MFG. COMPANY

"THE HACK SAW PEOPLE"

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Metal Cutting MARVEL SAWS

Better Machines–Better Blades

IF THIS IS YOUR PROBLEM

TRACER TURNING TOUGH ON TOOLS?

These tools will solve it!

Tracer turning has this great advantage—higher production rates can be attained, using far less skilled operators' time than is required for the conventional "cut and try" procedure.

But—any tracer lathe is only as good as the cutting tool it drives. The burden on the tool is great. It must have ruggedness for heavy stock removal and a long-lasting cutting edge able to maintain accurate duplication throughout the complete machining cycle.

Kennametal pioneered this field—has developed carbide tooling for light and heavy tracer lathe jobs, including roll profiling. With this tooling, tracer turning has reduced machining time as much as 80%*.

Our engineers will cooperate with you—give you the benefit of their industry-wide experience—develop the most suitable Kennametal tooling for your tracer operation. Write, telling us your problem. Kennametal, Inc., Latrobe, Pa.

*Performance studies will be sent upon request.

KENNAMETAL

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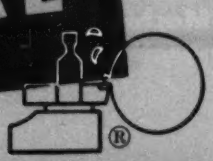

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Bristol Co., Platts Mills, Waterbury, Conn.

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U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORIES, Heat-Treating Furnace
Norton Co., 1 New Bond St., Worcester 6, Mass.

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General Electric Co., Schenectady, N. Y.

REMOVERS, Japan, Enamel, Etc.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

RETAINING RINGS FOR BEARINGS, Etc.
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Waldes-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

RHEOSTATS
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Westinghouse Electric Corp., Pittsburgh 30, Pa.

RIVET SETS
Bethlehem Steel Co., Bethlehem, Pa.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

RIVETERS, Hydraulic
Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hanna Engineering Works, 1752 Elston Ave., Chicago, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Morgan Engrg. Co., Alliance, Ohio.

RIVETERS, Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Hanna Engineering Works, 1752 Elston Ave., Chicago, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

RIVETING MACHINES
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Hanna Engineering Works, 1752 Elston Ave., Chicago, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Tomkins-Johnson Co., Jackson, Mich.

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Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
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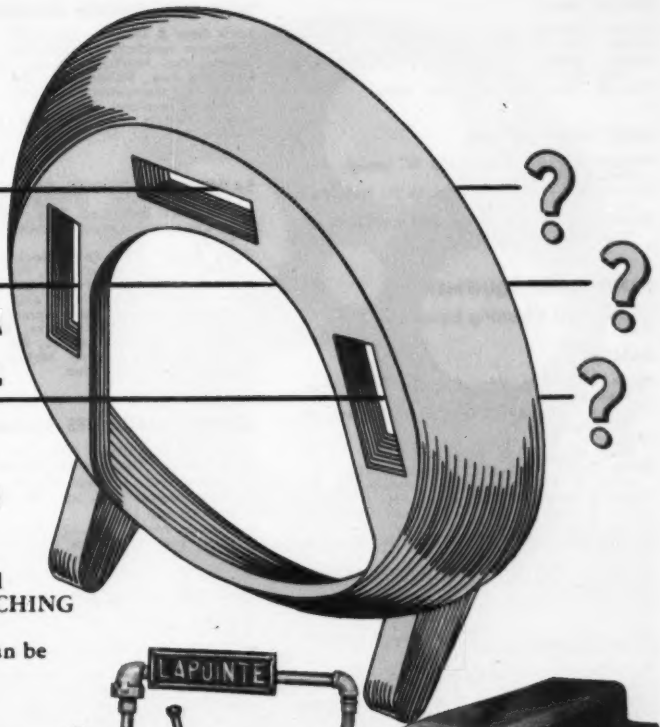
RUBBER PRODUCTS
Garlock Packing Co., Palmyra, N. Y.

(Continued on page 380)

HOW WOULD YOU

MACHINE THE ENDS OF THESE
3 RECTANGULAR HOLES, AT AN ANGLE,
IN THIS
COMMANDER'S CUPOLA
forged of ARMOR STEEL



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with LAPOINTE BROACHING!

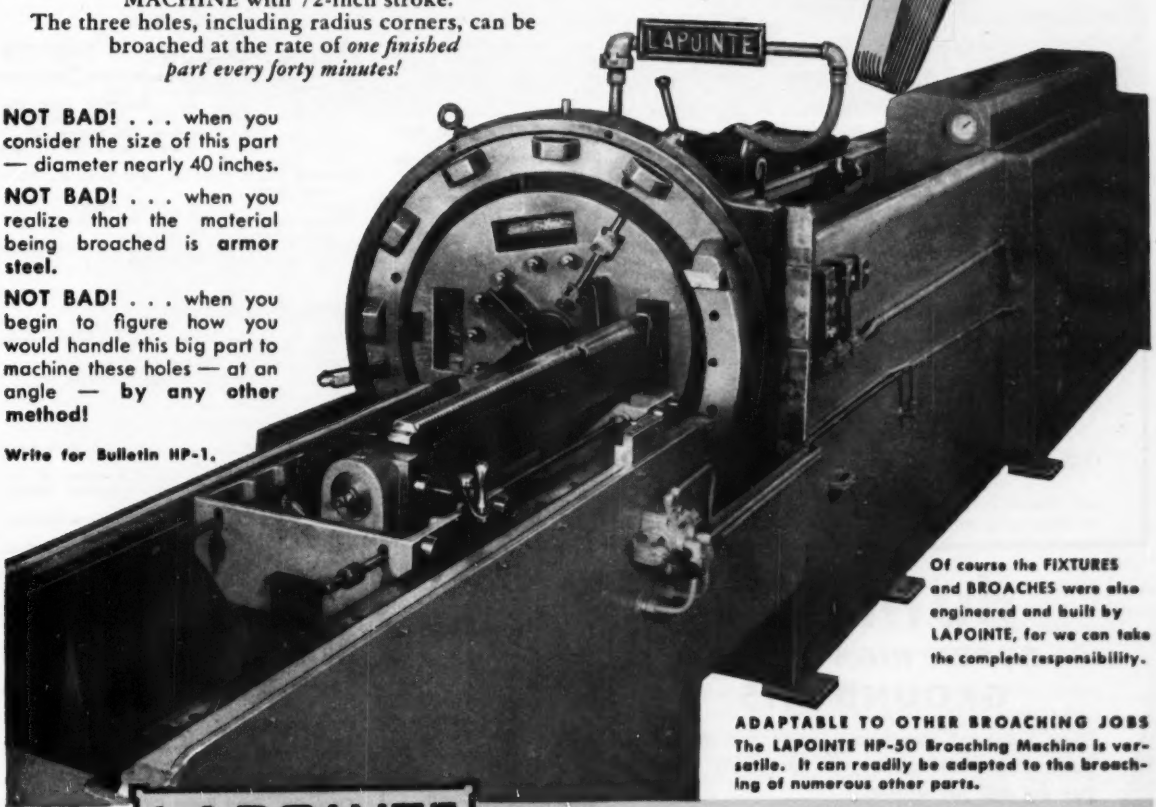
The best way to do it is to use this rigid 25-ton LAPOINTE HP-50 Horizontal BROACHING MACHINE with 72-inch stroke. The three holes, including radius corners, can be broached at the rate of *one finished part every forty minutes!*

NOT BAD! . . . when you consider the size of this part — diameter nearly 40 inches.

NOT BAD! . . . when you realize that the material being broached is **armor steel.**

NOT BAD! . . . when you begin to figure how you would handle this big part to machine these holes — at an angle — **by any other method!**

Write for Bulletin HP-1.



Of course the FIXTURES and BROACHES were also engineered and built by LAPOINTE, for we can take the complete responsibility.

ADAPTABLE TO OTHER BROACHING JOBS
The LAPOINTE HP-50 Broaching Machine is versatile. It can readily be adapted to the broaching of numerous other parts.

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HUDSON, MASSACHUSETTS • U. S. A.
Branch Factory: Watford, Herts., England

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SANDERS

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Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll-Rand Co., Phillipsburg, N. J.
Jarvis, Charles L., Co., Middletown, Conn.
Millers Falls Co., Greenfield, Mass.
Porter-Cable Machine Co., Salina St., Syracuse, N. Y.
Skil Corp., 5039 Elston Ave., Chicago, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

SAW BLADES, Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
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SAW SHARPENING MACHINES

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Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Earle Gear & Machine Co., 4707 Stenton Ave., Wayne Junction, Philadelphia 44, Pa.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.

SAWING MACHINES, Friction

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Kling Bros., Engineering Works, 1320 No. Kostner Ave., Chicago 51, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Tannewitz Works, 301-325 Front Ave., N. W., Grand Rapids 2, Mich.

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DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob Bros., Grafton, Wis.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Tannewitz Works, 315 N. W. Front, Grand Rapids, Mich.
Walker-Turner Div., Kearney & Trecker Corp., South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Victor Saw Works, Inc., Middletown, N. Y.

SAWS, Circular Metal Cutting

Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
Brown & Sharpe Mfg. Co., Providence, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Tannewitz Works, 301-325 Front Ave., N. W., Grand Rapids 2, Mich.
Union Twist Drill Co., Athol, Mass.
Triplex Machine Tool Corp., 125 Barclay St., New York, N. Y.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Tannewitz Works, 301-325 Front Ave., N. W., Grand Rapids 2, Mich.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Portable Electric

Black & Decker Mfg. Co., E. Penna Ave., Towson, Md.
Millers Falls Co., Greenfield, Mass.
Skil Corp., 5039 Elston Ave., Chicago, Ill.

SAWS, Screw Slotting

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCRAPERS, Hand and Power

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

SCREW DRIVERS, Power

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.

SCREW DRIVING AND NUT SETTING EQUIPMENT

Black & Decker Mfg. Co., E. Penna Ave., Towson, Md.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Jarvis, Charles L., Co., Middletown, Conn.

(Continued on page 382)

NEW BALANCED TOOL BITS do most cutting for you

du MOST®
SUPER HIGH SPEED
GROUND BITS

have balanced toughness, wear resistance, heat resistance—give you *the most cuts per bit and per dollar.*

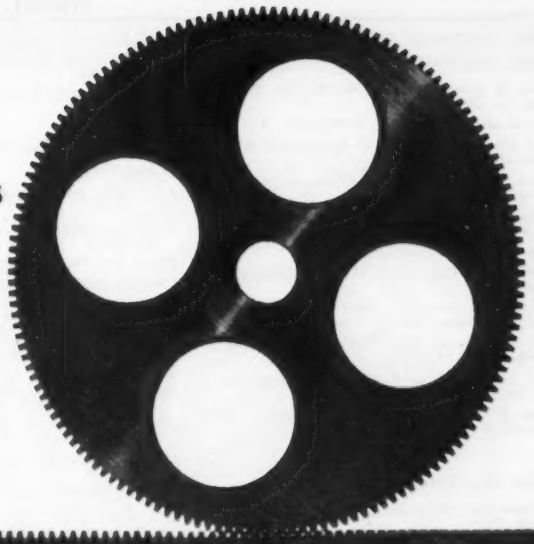
GET THE FACTS on du MOST Bits— CLIP THE COUPON

The du MONT CORPORATION
Greenfield, Massachusetts

Please mail Comparison Chart M-1 and complete information on Sizes and Prices of du MOST Tool Bits.

Name.....
Company.....
Address.....

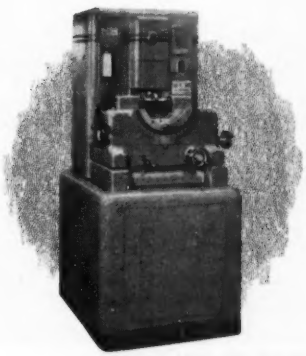
Here's *Why* you can check precision gears *more conclusively* with Kodak Conju-Gage Gear Checkers



Why the composite check

Errors in gears seldom occur individually—they're usually combinations of as many as six types of errors. The practical way to test gears for these errors is to test them in action through the composite check recommended in the new American Standard (AGMA 236.02; ASA B6.11-1951).

This check measures gear errors as variations in center distance when the gear is rotated in contact with a master of known accuracy. Since this variation is the sum of errors in both gear and master, the degree of precision measurable depends on the precision of the master.



The Kodak Conju-Gage Gear Checker automatically records the composite effects of runout, base pitch error, tooth thickness variations, profile error, lead error, and lateral runout. Illustrated is the Kodak Conju-Gage Gear Checker, Model 4U, for gears up to 4⅛" pitch diameter. Larger and smaller models are also available.

Why the Conju-Gage Gear Checker

Kodak Conju-Gage Gear Checkers use a master of exceptional accuracy, the Kodak Conju-Gage Worm Section. These Worm Sections are generated by the continuous action of a thread grinder under control of a precision lead screw—circular pitch error and tooth thickness variations cannot be introduced by defects in an intermittent indexing mechanism. This means a more accurate gaging element, less chance that error in the master may coincide with a tolerable error in the gear to result in a needless rejection. Less chance, too, that an error in the master may subtract from an intolerable error in the gear, passing a gear that will fail in use.

By passing each right gear, rejecting each wrong gear, the Kodak Conju-Gage Gear Checker helps you reduce costs while maintaining highest precision. For the full story of this and other economies achieved by Conju-Gage instrumentation, send for the booklet, "Kodak Conju-Gage Gear Testing Principle." Eastman Kodak Company, Industrial Optical Sales Division, Rochester 4, N. Y.

CONJU-GAGE INSTRUMENTATION

. . . a new way to check gear precision in action

To inspect all kinds of complex parts on a bright screen, Kodak also makes two highly versatile contour projectors.

Kodak

SCREW MACHINE TOOLS AND EQUIPMENT

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Millers Falls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINE WORK

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Eastern Mch. Screw Corp., New Haven, Conn.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., Co., York, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

SCREW MACHINES, Automatic Single and Multiple Spindle

Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Garton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
National Acme Co., 170 E. 131st St., Cleveland Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINES, Hand

See also Lathes, Turret.

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW PLATES

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

SCREWS, Cap, Set, Safety Set and Machine, Etc.

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Bristol Co., Platts Mills, Waterbury, Conn.
Chicago Screw Co., Bellwood, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., Co., York, Pa.
Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Set Screw & Mfg. Co., 35 Main St., Bartlett, Ill.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS, Self-Tapping Drive

Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.

SCREWS, Thumb

Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

SEALS AND RETAINERS, Oil or Grease

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

SECOND-HAND MACHINERY, Etc.

Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio.
Hill-Clarke Machinery Co., 648 W. Washington, Chicago 6, Ill.
Miles Machinery Co., Box 770, Saginaw, Mich.
Morey Mchry. Co., Inc., 410 Broome St., New York, N. Y.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

SEPARATORS, Centrifugal

De Laval Separator Co., Poughkeepsie, N. Y.

SEPARATORS, Oil or Coolant

Barnes Drill Co. (Magnetic), 814 Chestnut, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

SHAFTING, Steel

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
De Laval Separator Co., Poughkeepsie, N. Y.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.

SHAFTS

National Forge & Ordnance Co., Irvine, Warren County, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

SHAFTS, Flexible

Jarvis, Chas. L., Co., Middletown, Conn.

SHAFTS, Hollow Bored

Bethlehem Steel Co., Bethlehem, Pa.

SHAFTS, Turned and Ground

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
LaSalle Steel Co., Hammond, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SHAPER-PLANERS

Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPERS

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Columbia Machinery & Engineering Corp., Hamilton 1, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hendey Machine Co., Inc., Torrington, Conn.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Orban, Kurt, Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

SHAPERS, Vertical

British Industries Corp., International Mchry. Div., 164 Duane St., New York, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPES, Structural

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEARING MACHINERY

Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Columbia Machinery & Engineering Corp., Hamilton 1, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Kling Bros. Engineering Works, 1320 No. Kostner Ave., Chicago 51, Ill.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

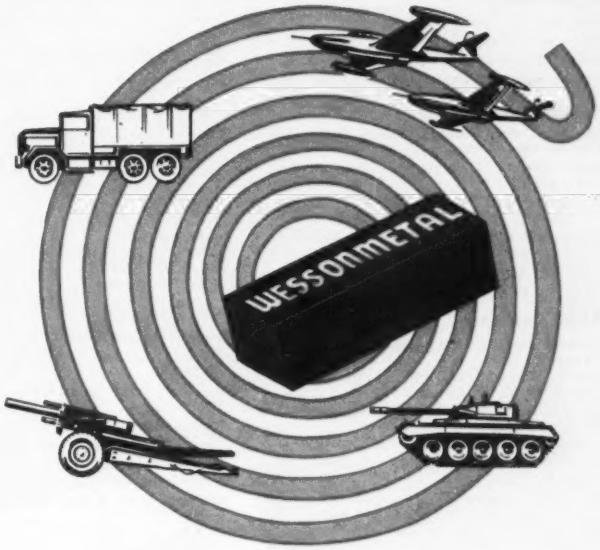
(Continued on page 384)

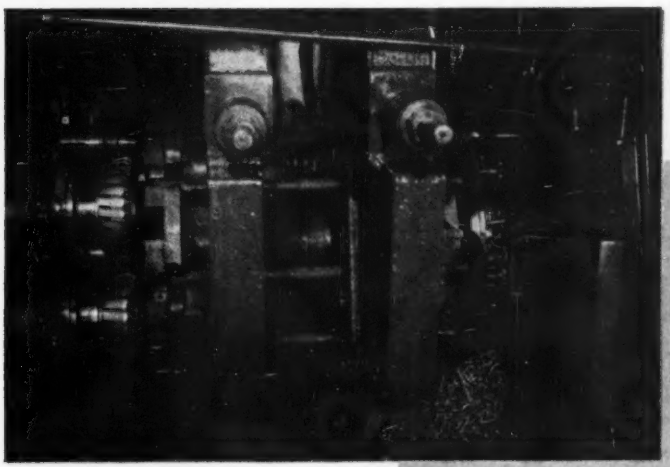
WESSONMETAL . . . The Carbide for Top Production

WESSONMETAL

MAINSPRING of PRODUCTION!

IN EVERY PHASE OF METAL MACHINING IN INDUSTRY TODAY





HERE'S AN OUTSTANDING EXAMPLE IN THE AUTOMOTIVE INDUSTRY

ACTUAL JOB	AUTOMOTIVE PLANT
Machine	Davis Thompson Milling Machine
Part	Rear axle shaft
Operation	Rough and finish mill spline end
Material	S.A.E. 1038—Brinell Hardness 179-229
Tools	Wesson 6" and 8" dia. Milling Cutters—fine pitch—bronze type
Speed	8"—387 S.F.M. 6"—290 S.F.M.
Feed	14" per min.
	Feed per tooth 8" dia. (28 teeth) .0021
	Feed per tooth 6" dia. (20 teeth) .0030
Production	130 pcs. per hour, 1500-1700 pcs. per grind
Grade of Carbide	Wessonmetal WM

Write for . . . the story of Carbide

THIS CARBIDE AGE

WESSON METAL CORPORATION
LEXINGTON, KENTUCKY
Affiliated with WESSON COMPANY, Detroit, Mich.

WESSONMETAL
Cemented Carbide

SHEARS, Alligator

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

SHEARS, Rotary

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.

Brown & Sharpe Mfg. Co., Providence, R. I.

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

Consolidated Mch. Tool Corp., Rochester, N. Y.

Kling Bros. Engineering Works, 1320 No. Kostner Ave., Chicago 51, Ill.

Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.

Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.

Union Twist Drill Co., Athol, Mass.

SHEARS, Squaring

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

Columbia Machinery & Engineering Corp., Hamilton 1, Ohio.

Consolidated Mch. Tool Corp., Rochester, N. Y.

Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.

Kling Bros. Engineering Works, 1320 No. Kostner Ave., Chicago 51, Ill.

Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.

Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.

SHEET METALS

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.

American Brass Co., 25 Broadway, New York, N. Y.

Bethlehem Steel Co., Bethlehem, Pa.

Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.

Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.

Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.

U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEETS, Iron and Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

Bethlehem Steel Co., Bethlehem, Pa.

Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.

Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

U. S. Steel Corp. (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

SHOP LAYOUT TEMPLETS

Repro-Templets, Inc., Oakmont, Allegheny County, Penna.

SHIMS

Laminated Shim Co., Inc., Glenbrook, Conn.

SLEEVES

Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.

Greenfield Tap & Die Corp., Greenfield, Mass.

Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

Morse Twist Drill & Mch. Co., New Bedford, Mass.

National Twist Drill & Tool Co., Rochester, Mich.

Pratt & Whitney, West Hartford 1, Conn.

Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.

Union Twist Drill Co., Athol, Mass.

SLOTTING MACHINES

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.

Consolidated Mch. Tool Corp., Rochester, N. Y.

Lobdell United Co., 2000 "G" St., Wilmington 99, Del.

Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.

Greenfield Tap & Die Corp., Greenfield, Mass.

Morse Twist Drill & Mch. Co., New Bedford, Mass.

National Twist Drill & Tool Co., Rochester, Mich.

Pratt & Whitney, West Hartford 1, Conn.

Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.

Union Twist Drill Co., Athol, Mass.

Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

SPECIAL MACHINERY AND TOOLS

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

Barnes Drill Co., 814 Chestnut, Rockford, Ill.

Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.

Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.

Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.

Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.

Bethlehem Steel Co., Bethlehem, Pa.

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.

Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.

Blanchard Mch. Co., 64 State St., Cambridge, Mass.

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.

Bunell Machine & Tool Co., 1600 East 24th St., Cleveland 14, Ohio.

Chambersburg Engineering Co., Chambersburg, Pa.

Colonial Broach Co., Detroit 13, Mich.

Columbia Machinery & Engineering Corp., Hamilton 1, Ohio.

Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.

Consolidated Mch. Tool Corp., Rochester, N. Y.

Earle Gear & Mch. Co., 4707 Stenton Ave., Wayne Junction, Philadelphia 44, Pa.

Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.

Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.

Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.

Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.

Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.

Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.

Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.

Jahn, B., Manufacturing Co., Ellis St., New Britain, Conn.

Kingsbury Mch. Tool Corp., Keene, N. H.

Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.

Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.

Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.

Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

Moline Tool Co., 102 20th St., Moline, Ill.

Morgan Engrg. Co., Alliance, Ohio.

Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.

National Acme Co., 170 E. 131st St., Cleveland, Ohio.

National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.

National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

National Tool Co., 11200 Madison Ave., Cleveland, Ohio.

National Twist Drill & Tool Co., Rochester, Mich.

New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.

New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.

Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.

Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.

Pioneer Engrg. & Mfg. Co., 19679 John R St., Detroit, Mich.

Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.

Pratt & Whitney, West Hartford 1, Conn.

Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.

Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

Seneca Falls Mch. Co., Seneca Falls, N. Y.

Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

Taft-Peirce Mfg. Co., Woonsocket, R. I.

Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

Union Twist Drill Co., Athol, Mass.

V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.

Waltham Machine Works, Newton St., Waltham, Mass.

Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

SPEED REDUCERS

Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, Ill.

Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.

Cone-Drive Gears, Div. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.

General Electric Co., Schenectady, N. Y.

Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.

Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.

Perkins Mch. & Gear Co., Box 1611 Springfield 2, Mass.

Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

Westinghouse Electric Corp., Pittsburgh 30, Pa.

(Continued on page 386)

Saves Time... Cuts Costs
Big Sawing • • • production cutting of large stock —rapid, easy, straight-to-a-line piece after piece—on Espen-Lucas Cold Sawing Machines.
Rotary Planer • • • do milling jobs in one-third to one-seventh of time on an Espen-Lucas Rotary Planer.
The ESPEN-LUCAS Machine Works
Front Street and Girard Ave., Phila. 23, Pa.
BUILDERS OF LARGE COLD SAWING MACHINES • ROTARY PLANERS • COLUMN FACERS • HEAVY TYPES OF SPECIAL MACHINERY

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Pope Mchry. Corp., Haverhill, Mass.

SPINNING LATHES
See Chucking Machines.

SPROCKET CHAINS
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

SPROCKETS
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

STAMPINGS, All Metal
LaSalle Steel Co., Hammond, Ind.

STAMPINGS, Sheet Metal
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Dayton Rogers Mfg. Co., 2824 13th Ave., S., Minneapolis 7, Minn.
Laminated Shim Co., Inc., Glenbrook, Conn.
Republic Steel Corp., Niles Steel Products Div., Republic Bldg., Cleveland 1, Ohio.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STAMPS, Steel and Marking Dies
Hoggson & Pettis Mfg. Co., 149 Brewery St., New Haven, Conn.

STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York 13, N. Y.
Holliday, W. J., & Co., Hammond, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
U. S. Steel Supply Div., U. S. Steel Co., 208 S. La Salle St., Chicago 4, Ill.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Cold Drawn
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., Massillon, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co., Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, High Speed Tool
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Machine
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Holliday, W. J., & Co., Hammond, Ind.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Stainless
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York 13, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Strip and Sheet
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York 13, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

STEEL, Tool and Die
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.

STEEL, Zinc, Tin and Copper Coated Strip
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.

STEEL ALLOYS
See Alloys, Steel.

STEEL BARS—See Bars, Steel.

STEEL STOCK GROUND FLAT
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.

STELLITE
Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

STOCKS, Die
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

STONES, Oil or Sharpening
Bay State Abrasive Co., Westboro, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.

STOOLS
Standard Pressed Steel Co., Jenkintown, Pa.

STRAIGHTEDGES
Rahn Granite Surface Plate Co., 637 N. Western Ave., Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.

STRAIGHTENERS, Flat Stock and Wire
Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

STRAIGHTENING MACHINERY
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., Detroit 13, Mich.
Columbia Machinery & Engineering Corp., Hamilton 1, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.

(Continued on page 388)

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RELEASING ACORN DIE HOLDER • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL • CARBIDE AND ROLLER BACKRESTS

Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

STRIPPING UNITS, Die

Wales-Strippit Corp., North Tonawanda, N. Y.

STUD SETTERS

Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.

SUB-PRESSES

Waltham Machine Works, Newton St., Waltham, Mass.

SUPERFINISHING MACHINES

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES

See Plates, Surface.

SWAGING MACHINES

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Torrington Co., Torrington, Conn.

SWITCHES

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
Electro-Snap Switch & Mfg. Co., 4218-30 West Lake St., Chicago 24, Ill.
General Electric Co., Schenectady, N. Y.
Micro Switch Div., Minneapolis-Honeywell Regulator Co., Freeport, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

TACHOMETERS

Bristol Co., Platts Falls, Waterbury, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

TAPER PINS, Standard

Chicago Screw Co., Bellwood, Ill.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.

TAP HOLDERS

Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.

TAPPING ATTACHMENTS AND DEVICES

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Commander Mfg. Co., 4233 W. Kinzie St., Chicago 4, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Jarvis, Chas. L., Co., Middletown, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

TAPPING MACHINES

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Challenge Mchry. Co., Grand Haven, Mich.
Cleveland Tapping Mch. Co., 1201 Camden Ave., S. W., Canton 6, Ohio.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Jarvis, Chas. L., Co., Middletown, Conn.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

TAPPING MACHINES, Nut

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

TAPS

Besly-Welles Corp., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Continental Tool Works, Div. Ex-Cell-O Corp., Detroit 32, Mich.
Detroit Tap & Tool Co., Detroit, Mich.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hy-Pro Tool Co., 100 Mt. Pleasant Ave., New Bedford, Mass.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.
Wood & Spencer Co., 1930 E. 61st St., Cleveland, Ohio.

TAPS, Collapsing

Geometric Tool Co., Westville Station, New Haven 15, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

TELESCOPES, Alignment

Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill.

THERMOMETERS, Indicating and Recording

Bristol Co., Platts Mills, Waterbury, Conn.

THREAD CUTTING MACHINERY

Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Tapping Mch. Co., 1201 Camden Ave., S. W., Canton 6, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Detroit Tap & Tool Co., Detroit, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

THREAD GAGES

See Gages, Thread.

THREAD GRINDING MACHINES

See Grinding Machines, Thread.

THREAD MILLING MACHINES

Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Waltham Machine Works, Newton St., Waltham, Mass.

THREAD ROLLING MACHINES

Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.

TIN AND TERNEPLATES

Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div, Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

TOOL BITS, High Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

(Continued on page 390)

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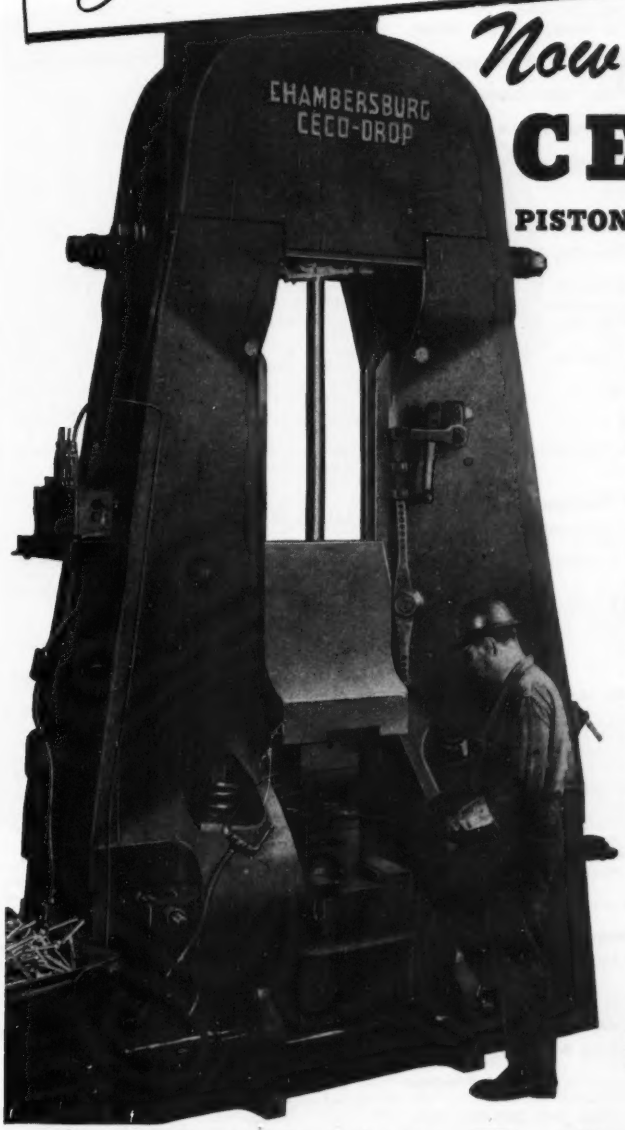

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TOOL BITS, Special Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL GRINDERS

See Grinding Machines for Sharpening, Turning and Planing Tools.

TOOL HOLDERS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Blake, Ed., Co., 442 Cherry St., West Newton 65, Mass.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Lovejoy Tool Co., Inc., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Portage Double Tool Co., 1036 Sweitzer Ave., Akron 11, Ohio.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOLMAKERS' INSTRUMENTS

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

TOOL STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.

TOOLS, Carbide-Tipped

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Atrax Co., Newington, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Colonial Broach Co., Detroit 13, Mich.
Kennametal, Inc., Latrobe, Pa.
Metal Carbide Corp., Youngstown, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Severance Tool Industries, Inc., 636 Iowa Ave., Saginaw, Mich.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

TOOLS, Lathe, Shaper and Planer

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Inc., Springfield, Vt.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

TRANSFER MACHINES, Automatic

Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Colonial Broach Co., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TRANSFORMERS

General Electric Co., Schenectady, N. Y.

TRANSMISSION, Variable Speed

Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Reliance Elec. & Engrg. Co., Collinwood Station, 1088 Ivanhoe Rd., Cleveland, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TUBE FLANGING MACHINES

Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.

TUBE FORMING AND WELDING MACHINES

American Elec. Fusion Corp., 2606 Diversey Ave., W., Chicago, Ill.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

TUBING, Aluminum

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.

TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

TUBING, Flexible

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.
Titeflex, Inc., 500 Frelinghuysen Ave., Newark 5, N. J.

TUBING, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Frasse, Peter A., & Co., Inc. (Seamless), 17 Grand St., New York 13, N. Y.
Republic Steel Corp., Steel & Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., National Tube Co. Div., 436 7th Ave., Pittsburgh, Pa.

TWIST DRILLS

See Drills, Twist.

UNIVERSAL JOINTS

Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

VALVE CONTROLS

Philadelphia Gear Works (Motorized), Erie Ave., and G St., Philadelphia, Pa.

VALVES, Air

Hanna Engineering Works, 1752 Elston Ave., Chicago, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ross Operating Valve Co., 120 E. Golden Gate, Detroit, Mich.

VALVES, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

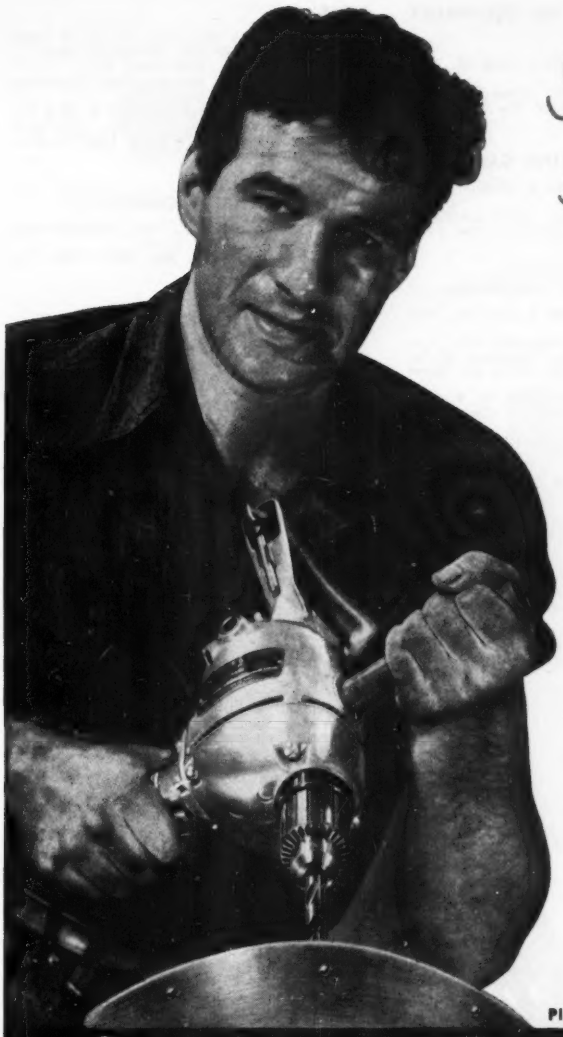
VIBRATION INSULATION

American Felt Co., Glenville, Conn.

VISES, Machine

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Fenn Mfg. Co., Hartford, Conn.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hendey Machine Co., Inc., Torrington, Conn.
Homestrand, Inc., Larchmont, N. Y.
Logansport Machine Co., Inc., Logansport, Ind.
Martin, J. E. Mch. Works, 548 W. State St., Springfield, Ohio.
Neise, Karl A., Dept. M, 381 Fourth Ave., New York 16, N. Y.

(Continued on page 392)



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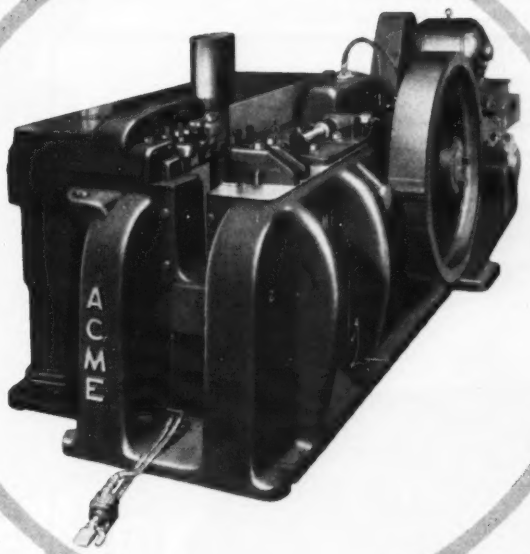

Heavy clevis for **FARM MACHINERY** forged on the rod with 2½" ACME XN Forging Machine. Est. production—265 per Hr.

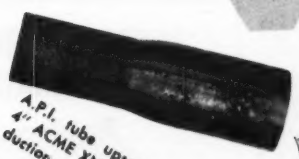

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Fig. 4. Original Construction *of marking machine. Had high rejection rate in castings. Required considerable machining and finishing. Weighed 83 pounds.*

Fig. 3. Welded Design. *Cuts manufacturing cost 25%, weighs 33% less. Cabinet type base is now fabricated from 16 gauge metal and welded in simple fixture. Steel design eliminates entire cost of machining and handling originally required.* Courtesy National Marking Machine Company, Cincinnati, Ohio.

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Fig. 1. Original Construction *of multiple punch press. Material cost was $.10 per pound from this manufacturer's own foundry. Weight was 56,000 pounds.*

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Fig. 2. Welded Steel Design *is actually more rigid than former casting yet weighs only 49,550 pounds. Modern in appearance . . . costs 15% less.* Courtesy Williams-White and Co., Moline, Illinois.

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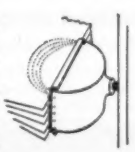

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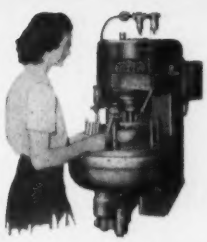

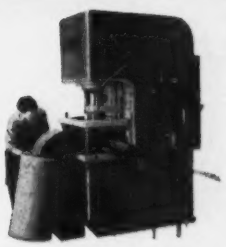

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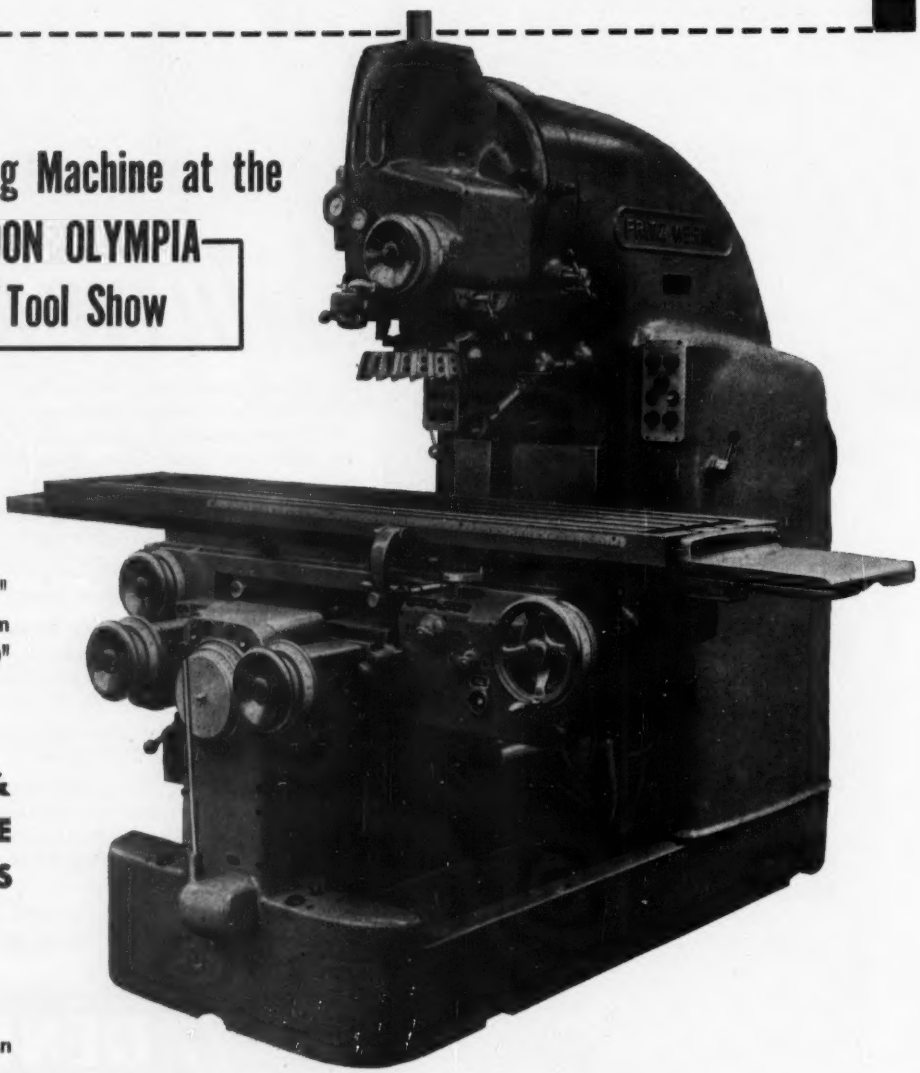

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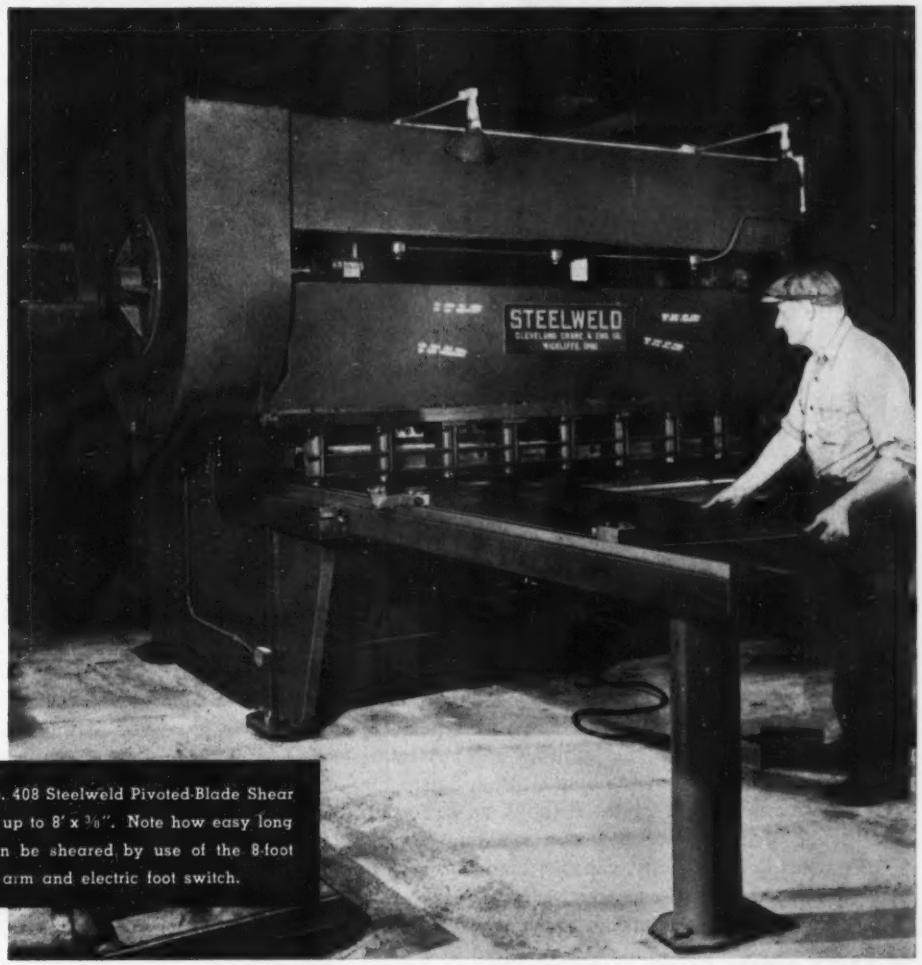

Series No. 408 Steelweld Pivoted-Blade Shear for metal up to 8' x 3/8". Note how easy long plates can be sheared by use of the 8-foot squaring arm and electric foot switch.

The easy knife clearance adjustment is one of the features that Johnston & Chapman Co., Chicago, greatly appreciates about their Steelweld Shear. Since they produce perforated metal of various thicknesses, which must have sharp, burrless edges, it is essential that the knives always be set with the right clearance to make the best possible cuts.

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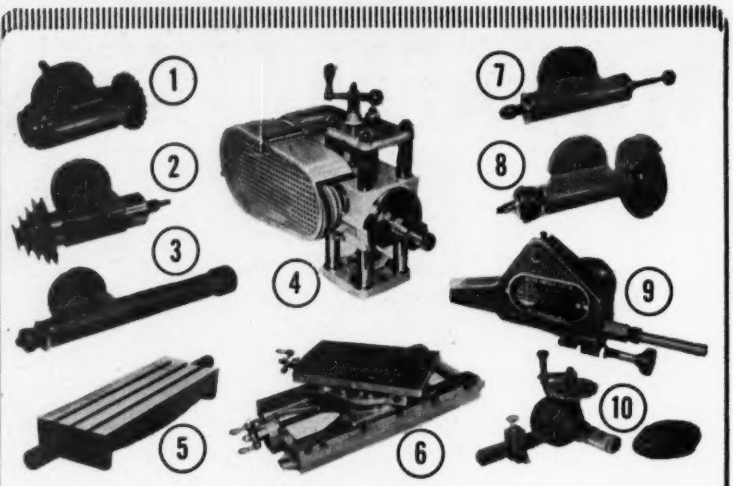

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The Master attachment can be used profitably on many production operations. Mount it on your present equipment, lathes, turrets, mills, or use independently to perform additional operations in the same set-up. The basic milling unit with the above types of precision heads gives you facilities for milling, grinding, boring, drilling, indexing, slotting, and keyseating, both internal and external. Therefore, the Master with its full complement of equipment is an outstanding value for general purpose use in maintenance, repair, tool room, and experimental shops, as well as production, thus providing equipment that performs a full range of shop operations at a minimum investment. These improved models of Master attachments are outstanding in rigidity, capacity, and simplicity of set-up and operation and incorporate the latest features developed in our seventeen years of manufacturing this tool. Investigate this valuable shop tool. For the cost of one single-purpose machine, you can have several Master units producing. Prompt deliveries.

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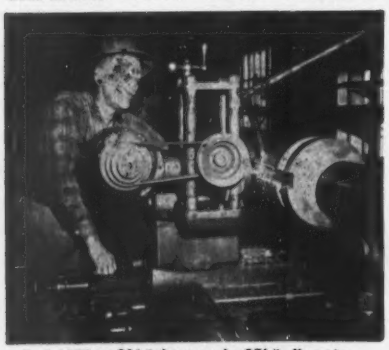
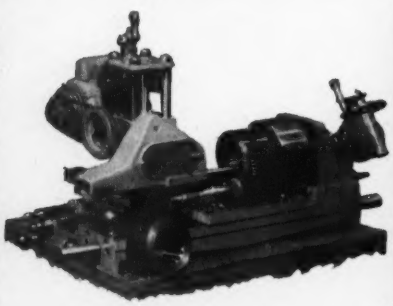
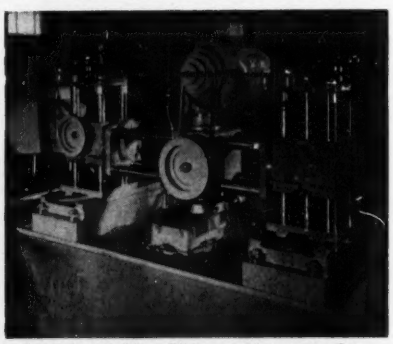


End Milling 2½" keyway in 9⅞" diameter shaft 22 ft. long.



Master portable keyseating and slotting head cutting internal splines on bench set-up.



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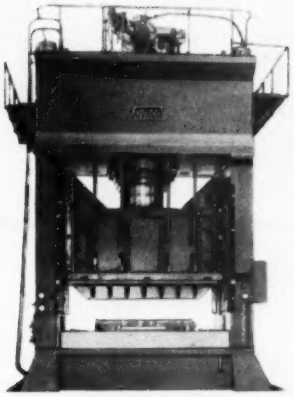
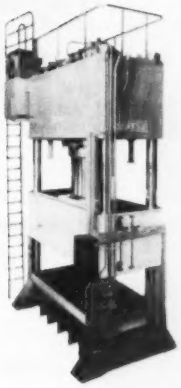
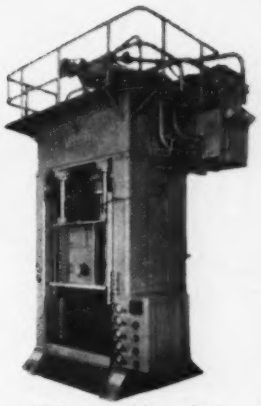


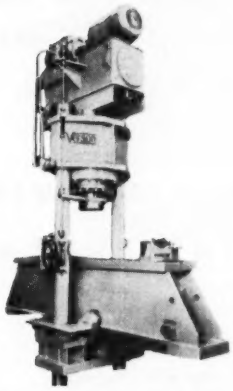
1200 ton straight side



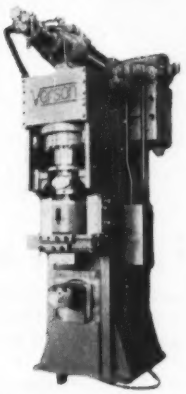
750 ton post type



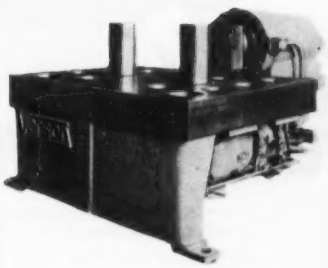
400 ton double action



400 ton straightening press



300 ton horn press



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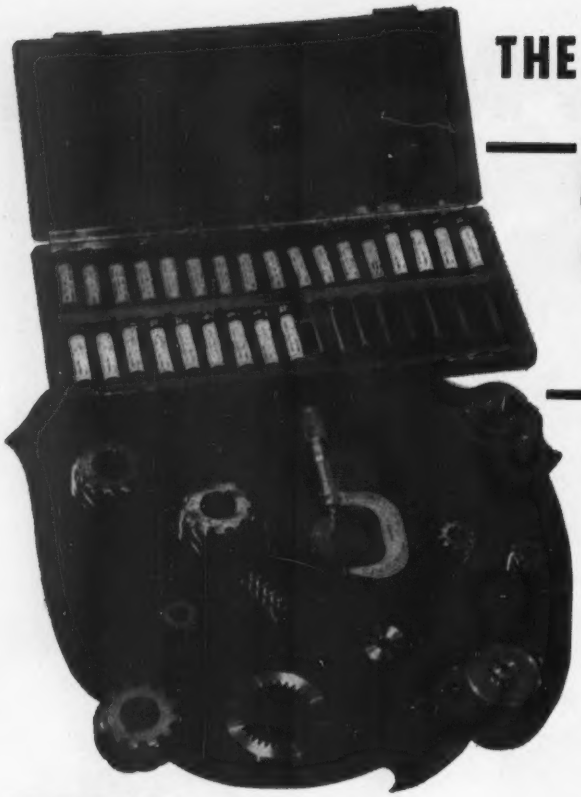

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- table of relationships between depth of cut and tooth thickness for common pressure angle gears.
- definitions and exact formulas covering involute spur gears.
- tables of involute tooth parts for standard addendum and stub tooth involute gears.
- information, formulas and examples regarding the wire measurement of helical gears.
- information and examples concerning the wire measurement of enlarged pinions and reduced gears.
- tables of wire measurement for involute splines.
- tables of wire measurement for involute serrations.
- tables of comparative measurement over three sizes of wires for use in involute profile checking.

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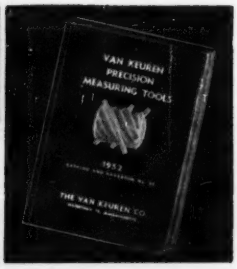

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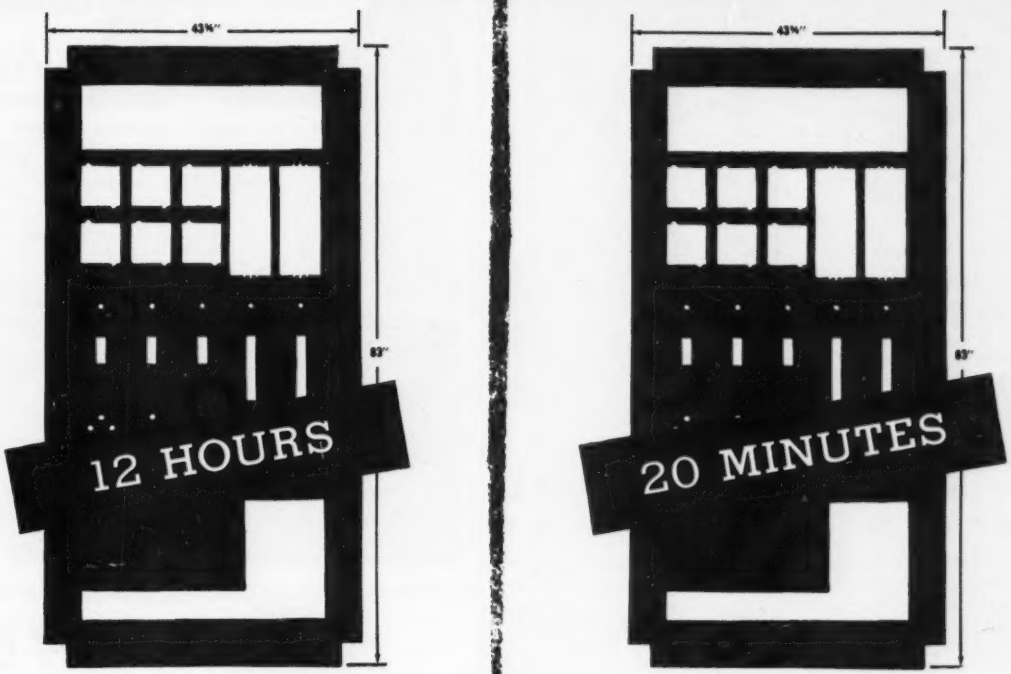

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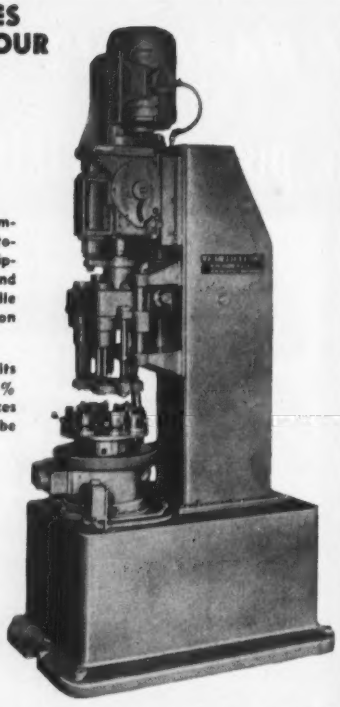

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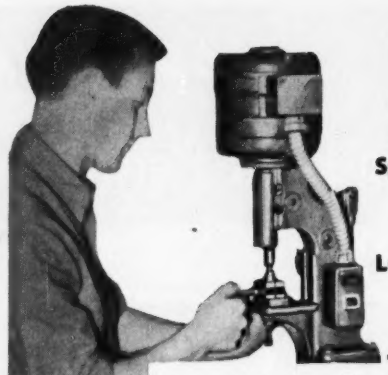

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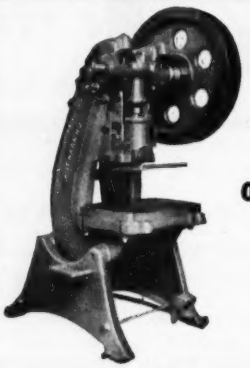

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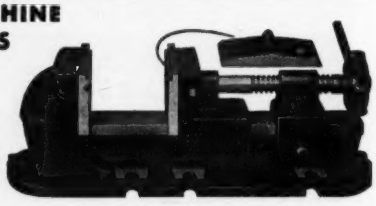

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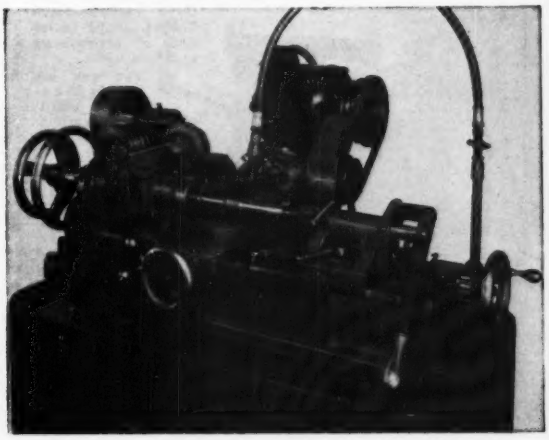

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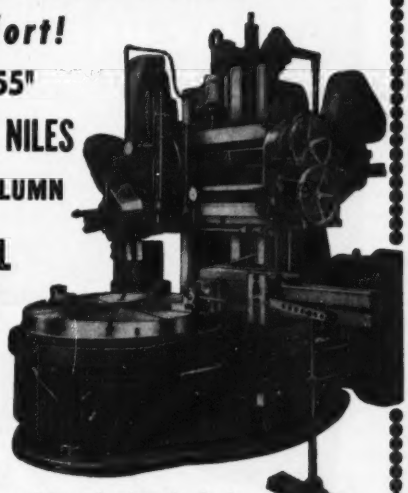

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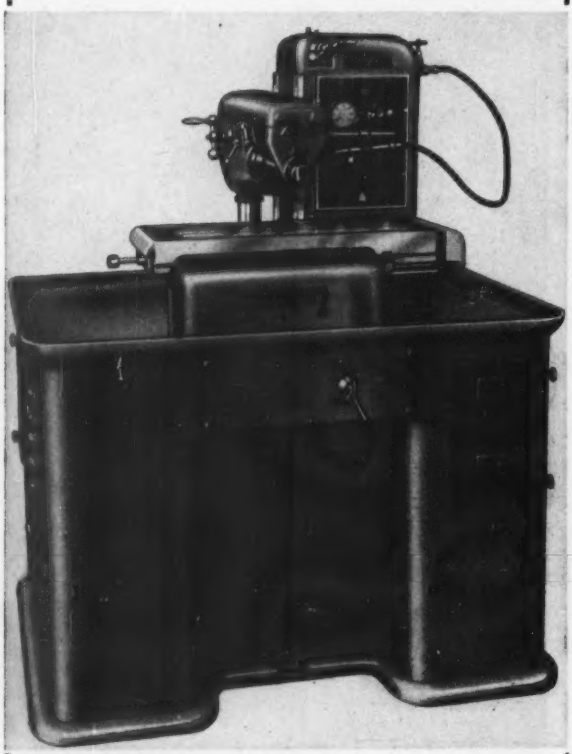

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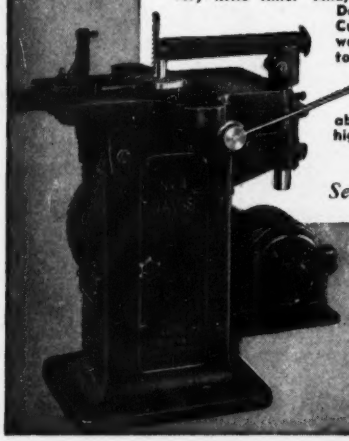

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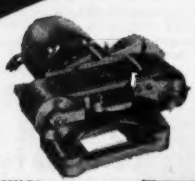

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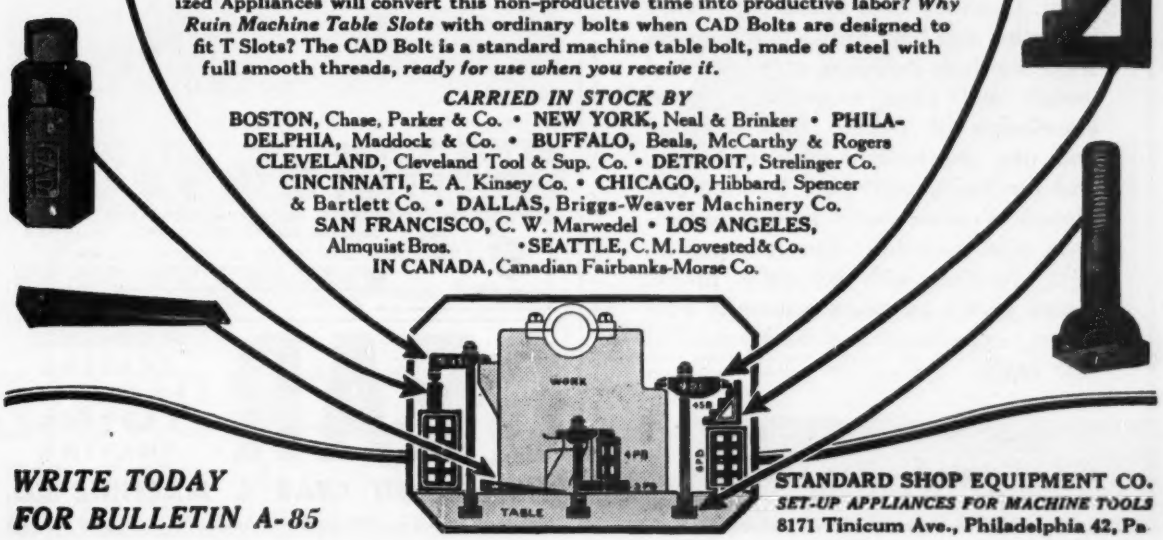

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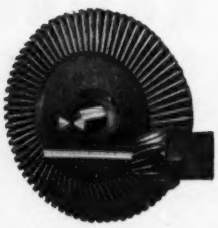

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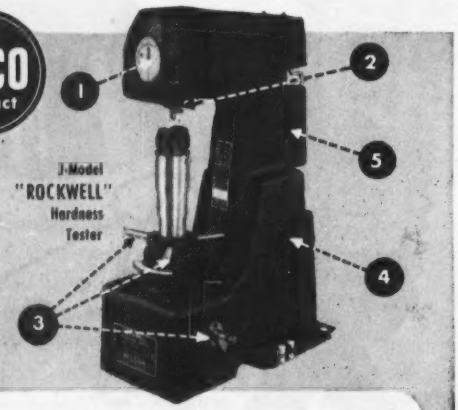

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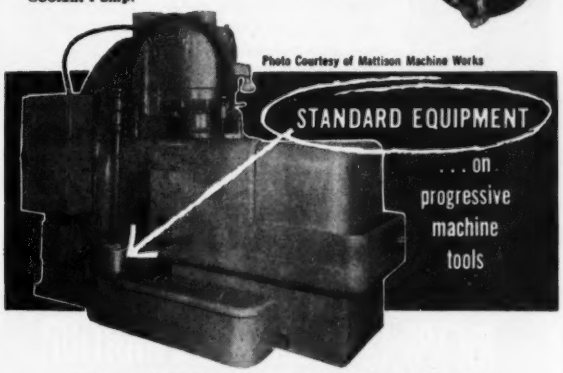

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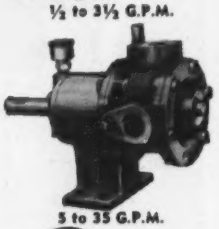

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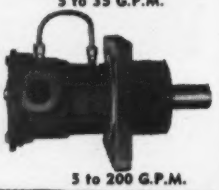

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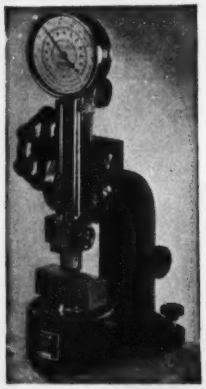

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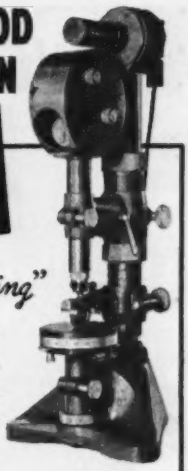

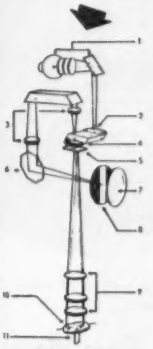

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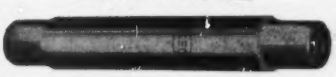

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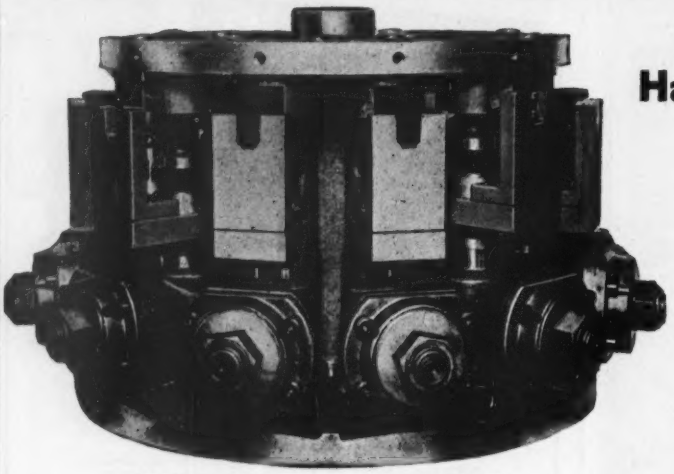

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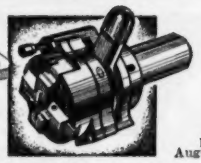

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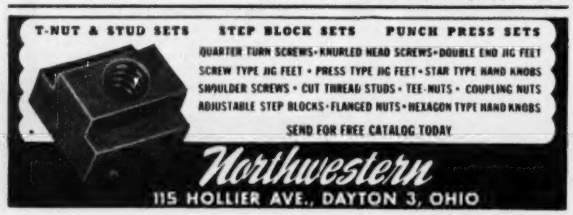
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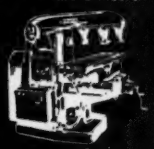
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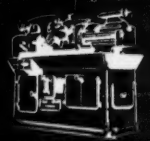
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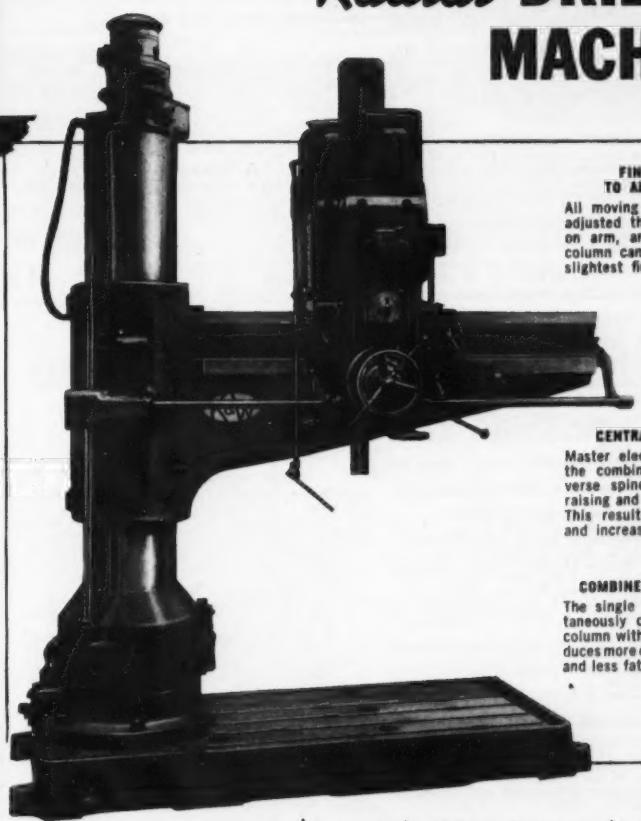

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Traverse of Saddle Along Arm	34⅜"	46¾"	55"	74"	96"
Morse Taper of Spindle	No. 4	No. 4	No. 5	No. 5	No. 5
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Spindle Speeds — Range RPM	80-1500	80-1500	50-1250	8½-800	8½-800
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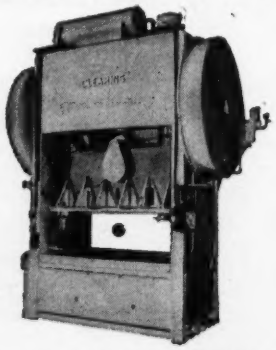

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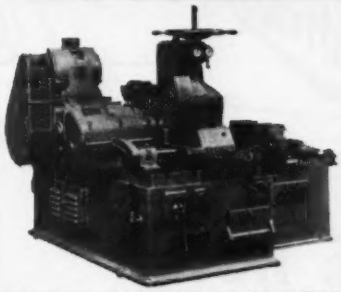

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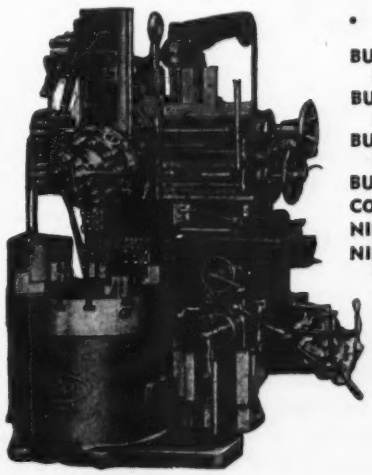

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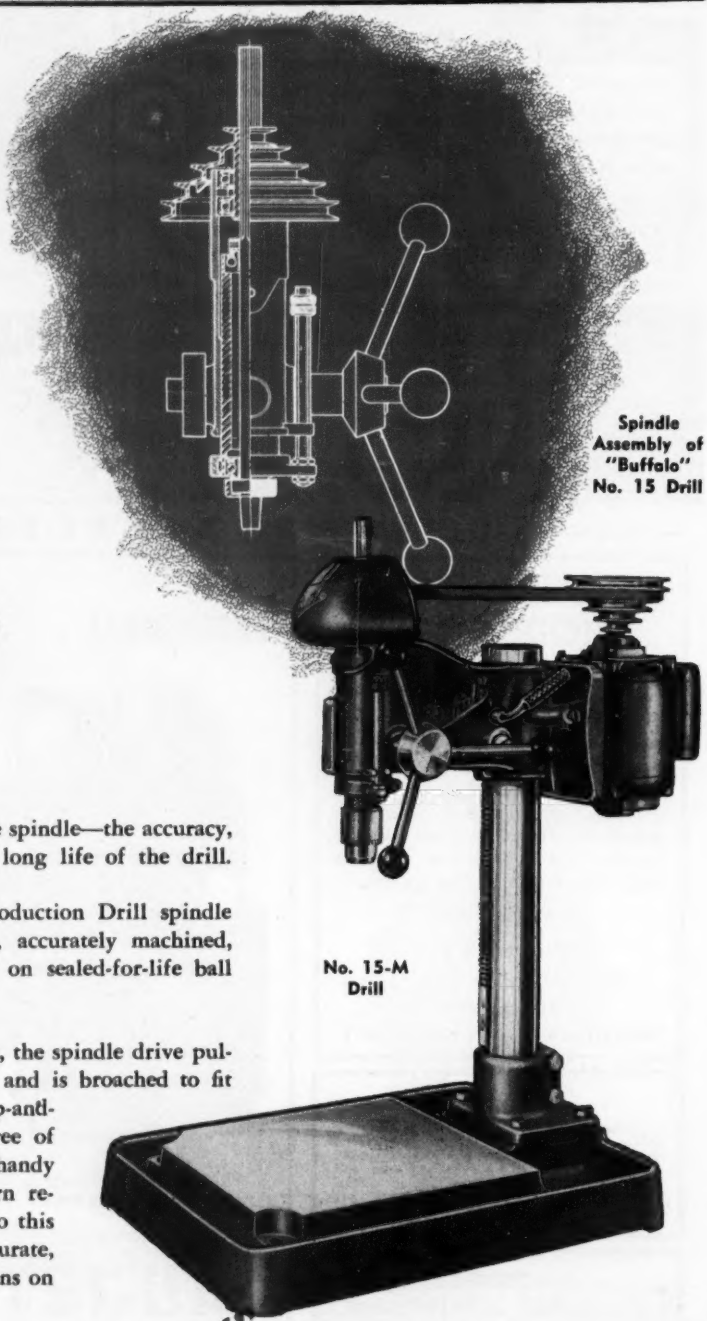

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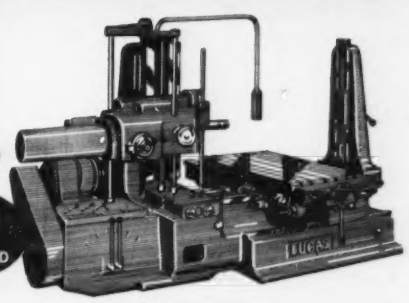

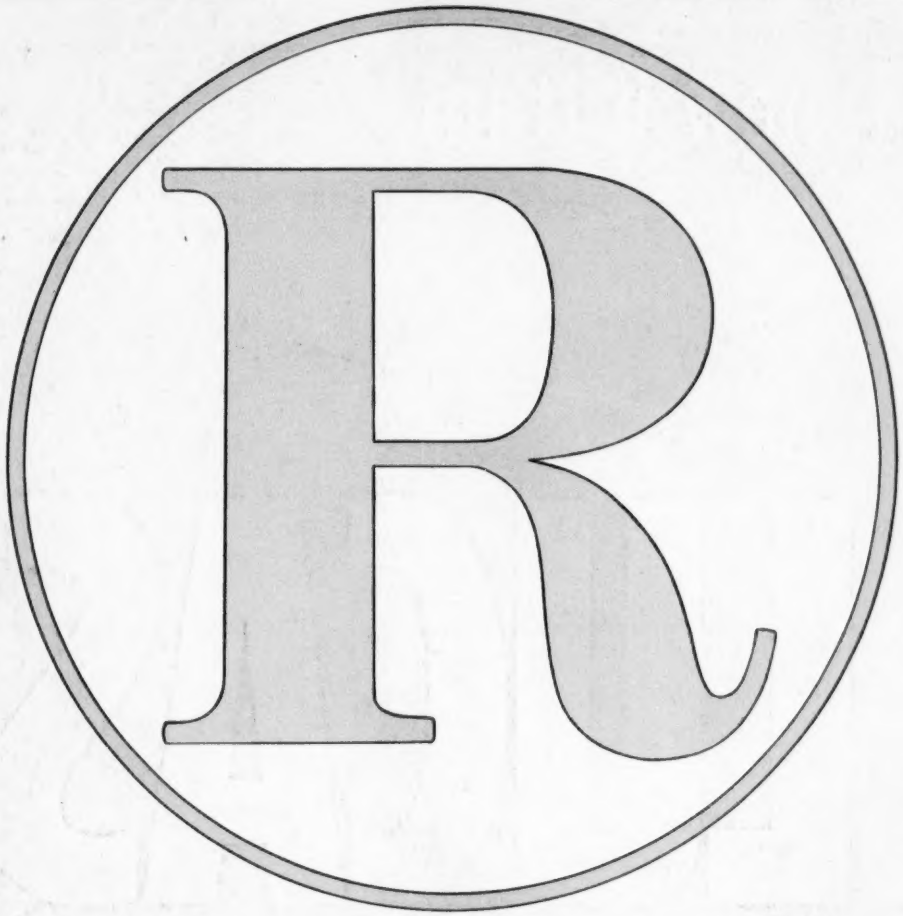

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